DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 1 January 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

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A major weapon system is comprised of hundreds of subsystems, tens of thousands of parts, and hundreds of thousands of connections and lesser components. Management of major weapon systems acquisition is discussed in article beginning on page 1.

Management of Major Weapon System Acquisition

Honorable Barry J. Shillito

In today's environment, much criticism has been levied against the Defense Department. A sizeable portion of such criticism has been directed at the way in which DOD has in the past managed the acquisition of major weapon systems.

My purpose in this article is neither to defend nor to condemn such criticism, but rather to raise the general level of understanding of the nature of the management problems involved in bringing into our operational inventory a major weapon system for our national defense. Additionally, I shall describe some of the changes in our methods and procedures, which our extensive review of this process have shown to be necessary, if we are to effect the improvements all of us desire.

At the outset it is important to recognize that in dealing with these complicated weapon systems of the future requiring such substantial outlays of public funds, we are faced with the problem of managing the weapon system acquisition process in an environment that is constantly changing. With change comes risks of varying size and composition which management must face. How DOD management deals with these categories of risks becomes a central issue in understanding the major weapon system acquisition process.

First, let me identify and briefly discuss the nature of these risks which we expect to some degree in every weapon system, and to a larger degree in every major weapon system.

Management Risks

The first category of risks involves the time it takes to acquire a weapon system.

A major weapon system acquisition has a time span of five to seven years, and sometimes longer. It is comprised of hundreds of subsystems, tens of thousands of parts, and hundreds of thousands of connections and lesser components. The interfaces and linkages on which the system's successful performance depends can run into the millions. Dealing as we are so far in the future, DOD managers must effectively deal with the risks of making cost projections over this time span, and stand accountable for decisions made.

Another category of risks that must be successfully dealt with is caused by the fact that a major weapon system involves nearly every field of technology. Over the past few years, the technologies have had a growth rate unparalleled with any similar prior time period. In any single weapon system, a significant number of these expanding technologies are often interdependently tied together. In looking downstream, DOD managers must resolve the nature and amount of forecasted growth in an array of technologies that can, optimally, be counted on for inclusion in a major weapon system to be operational so far in the future. There are substantial risks in doing this.

The ever-changing levels of capa-

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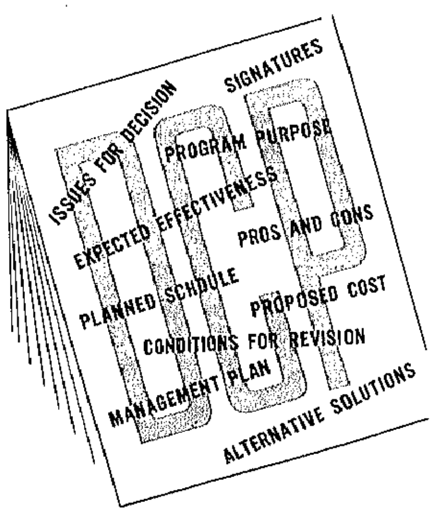
bility of our current or potential adversaries present another form of risk that must be effectively dealt with. The weapon system must also be designed to meet a forecasted threat derived from such variables as support of our international commitments, obsolescence of our current weapon systems, an unsolvable strategic or tactical problem, changing threats, greater weapon systems effectiveness, or a combination of any or all of these. In undertaking the development and production of a major weapon system, our management process must be responsive to the needs of effectively resolving the risks presented by this facet of this dynamic environment.

Another category of risk that our weapon system acquisition management must face is that, in developing and producing a weapon system that has not existed before, provision must be made for the proper identification and timely resolution of the many uncertainties our past experience tells us attend such an effort—the "unknowns" as one study described them. Even more important, when these foreseeable uncertainties, in turn, surface unforeseeable "unknowns," our management process must be able to prevent or minimize degradation to cost, schedule, or performance of the weapon system that has occurred in the past.

Finally, the contracting effort in support of the weapon system acquisition process must provide the degree of flexibility necessary to deal effectively with the kinds of risks peculiar to the weapon system in question. The contracting process must be responsive to the range of risks, balancing the opportunities for economic gain to the contractor with quality and timeliness of his performance in developing or producing the weapon system.

Development Concept Paper

As mentioned before, a major weapon system acquisition program involves the expenditure of very large amounts of public funds over a five-to-seven year period. It is important to provide a means by which the Secretary of Defense and his principal advisors can make a comprehensive review and decision on a major program, before heavy financial resources are committed to its development. The continuously improving



management process which provides such a mechanism is the Development Concept Paper (DCP).

The officer who has the primary responsibility for DCPs in DOD is the Director of Defense Research and Engineering. It is his responsibility to ensure the initiation of a DCP at the appropriate time in the life cycle of an important system. Important systems are those which are anticipated to require at least $25 million of research, development, test and evaluation funds or $100 million of production funds, or both; are high priority or are otherwise important, *e.g.*, because of unusual organizational complexity or technological advancement. The most common point at which DCPs have been introduced has been when a sponsoring Military Service is ready to go from concept formulation into contract definition.

The broad objectives of this management system are to improve decision making and implementation on important development programs by increased assurance that:

• Full military and economic consequences and risks of these programs are explored before they are initiated or continued.

• Information and recommendations on these programs are prepared collaboratively or coordinated with all interested parties, prior to review and decision by the Secretary of Defense.

• Premises and essential details of his decision on these programs are regularly recorded, and made known to all those responsible for their implementation.

• Opportunity for review is provided to the Secretary of Defense if any of the information or premises, on which his decision was based, change substantially.

The contents of a typical Development Concept Paper are:

Issues for Decison. Management issue or issues involved.

Program Purposes. Threat which the system is designed to meet or exceed; in short, the reason for the system.

Alternative Solutions. Are there different ways of meeting the threat on fulfilling the military mission?

Proposed Cost of the System. Expected effectiveness of the system in meeting the threat, and the planned schedule on which the system would be developed and put into production.

Pros and Cons. Is the system, in fact, needed? Would it be cheaper, for example, not to have such as system at all, but to take certain recognized losses that we might face in combat if we did not have this sytem?

Threshold Page. A most important part, because it is the gross management tool which the Secretary of Defense will use thereafter to ensure that the system is remaining on track throughout its life. In the case of an aircraft, the threshold sheet would contain figures on technical and operational performance, such as the maximum weight growth which would be allowed before the entire development program is reopened for review by the Office of the Secretary of Defense. Similarly, other thresholds, having to do with cost and with schedule, are established in this portion of the DCP. For example, if the estimated cost of a system in development is $100 million, a threshold of say $110 million might be established. Within these bounds, the sponsoring Military Service is fully responsible for the entire management of the program. If, however, a system runs over or threatens to run over the $110 million threshold figure, then the system is fully examined, not only by the sponsoring Service, but by the Office of the Secretary of Defense. A new DCP may be written, and a new decision may be made.

Management Plan. How does the Service plan to manage the program? What is the composition of the System Program Office?

Matter of Security. What has to be classified about the development? What can be unclassified? This is very important with respect to indus-

trial considerations.

Conditions for Revisions. As previously indicated, a DCP is supposed to be a living document which can be referred to throughout the life of the system and found to be accurate at any time. The DCP will normally be updated at the end of contract definition so that it contains more accurate figures on the system, its performance, its schedule, and its cost. Similarly, the DCP is updated at the time the production decision is made. This updated DCP is to ensure that we go forward into production with a valid and current understanding of the major features of and surrounding the system, including the threat which it is intended to meet, the performance parameters, and the cost and schedule features.

Decison Options or Alternatives. The Secretary of Defense is presented various alternatives from which he may choose, such as to allow the candidate system to go into contract definition. Another alternative might be not to go ahead with contract definition, but either to perform further advanced development or simply not to develop this system in favor of developing another one, or making another do to meet the mission requirement.

Signatures. A DCP contains the signatures of the Director of Defense Research and Engineering, the sponsoring Service Secretary, certain Assistant Secretaries of Defense (such as Installations and Logistics, Comptroller, Systems Analysis), and then the signature of the Secretary of Defense or the Deputy Secretary indicating his decision.

Defense Systems Acquisition Review Council

As a means of providing management overview for timely decision making, Secretary of Defense Laird has established the Defense Systems Acquisition Review Council. The mission of the council is to review major and important weapon system acquisition programs at appropriate milestone points in their life cycle. These reviews are to permit coordinated evaluation and deliberation among senior managers, to assure that the advice given the Secretary of Defense is as complete and objective as possible prior to a decision to proceed to the next step of the system's life cycle. The operation and evaluation of this council serves to complement the Development Concept Paper system.

The Defense System Acquisition Review Council is composed of the Director for Defense Research and Engineering and the Assistant Secretaries of Defense for Installations and Logistics, Systems Analysis, and Comptroller. While the council can meet as the need dictates, or at the request of an individual Service, the council will generally review and evaluate the status of each appropriate program at three basic milestone points:

When initiation of contract definition (or equivalent effort) is proposed.

When transition from contract definition to full-scale development is proposed.

When transition from the development phase into production for Service deployment is proposed.

The council is chaired by the Director of Defense Research and Engineering for consideration of entry into contract definition, and for entry into full-scale development. For the transition from development to production, chairmanship of the council shifts to the Assistant Secretary of Defense (Installations and Logistics). For additional reviews, the council will be chaired by either of these two officials, as appropriate. Thus, it can be seen that before a major system can move to the next important step in its life cycle, it must pass the scrutiny of senior DOD managers. They determine that satisfactory progress has been made and is expected to continue, in accordance with the finite original and updated plans for accomplishing the acquisition of the system. The council is then in a position to make recommendations for decision to the Secretary of Defense or the Deputy Secretary of Defense.

Continuing Study of Acquisition Process

As mentioned at the outset, we have been subjecting the entire weapon system acquisition process to intensive study. There are areas which are subject to improvement. We are looking at them in order to determine how best to proceed.

One such area is the source selection process and decision making attendant to it. This involves the whole matter of concept formulation and contract definition:

How we narrow down to and, finally, select one contractor.

How and when we make the various decisions relative to development and readiness for production.

How we select the type of contracting which is best fitted to a particular program.

We are generally convinced that over the years management changes have been made basically in the right direction. Problems were identified in the mid- and late 1950s with respect to improving the disciplines of weapon system management. Since that period, there has been a continuum of improvements in this area. However, contracting methods, as well as concept formulation and contract definition policies and regulations, may have moved so far that we have deprived ourselves of appropriate flexibility to allow the most effective acquisition to take place.

There have been many criticisms in the past few years by industry that it has been forced by the Government, or by the prevailing environment, into making over-optimistic estimates of the cost and schedule of the development and production of a system, in order to allow themselves any real chance of winning the competition. DOD does not want industry to be over-optimistic. We want to be informed what industry considers to be an accurate appraisal of the development risks ahead in a program. The Government is prepared to pay a fair price for a system, provided we are assured that the system is needed and we can make an estimate ahead of time of what it is going to cost, so we can evaluate its military utility *versus* its cost. It is not the desire of DOD to put a contractor in a position where he must take an overly optimistic view of the risks ahead, in order to give himself any opportunity to be successful in the competition.

On the other hand, we must know what we may encounter in the way of costs and development problems. We feel we cannot shift to the other end of the scale, where we would do business completely on a cost-plus basis without regard to evaluation of the risks ahead. In this connection, we are

convinced at the present time that we would be well advised to attempt to do more design validation and more prototyping rather than to depend, as much as we have, on paper estimates and paper analyses of what risks lie ahead of us. Quite desirable, of course, would be to have competitive prototypes for every system or every component that we develop. This, as we all recognize, is not practical. It is far too expensive, for example, and too time consuming to build two complete competitive aircraft weapon systems, and to fly them one against the other to decide which one we want to buy.

It is feasible, however, to conduct prototype competitions of certain major subsystems, such as engines, avionics, radars, or even aircraft missile systems. Such competitions might logically be conducted with a prime contractor's subcontractors, depending upon the circumstances. We believe that we may have been making our decisions to produce too early in the life of a system. We may be well advised, in many cases, to attempt to carry competition farther along than we have, until we are assured that more of the risks involving unknowns are behind us—until we, indeed, have purely engineering ahead rather than experimental development, and until contractors can make more accurate estimates of what the remaining development and production of a system will entail. All these things are involved in the source selection and decision making. We are looking at them carefully, and expect to make changes indicated by our studies as soon as we have convinced ourselves that we are moving in the right direction.

Milestone Contracting Concept

We are presently attempting to structure into the weapon system contract, at the time of initial award, a discrete number of significant milestones which permit objective evaluation of the contractor's actual accomplishment, as against the planned accomplishment. Included in both the development phase and in the initial production phase, the attainment, or lack of attainment, of such milestones will give enhanced visibility to the technical progress of the program.

The milestones chosen will be meaningful and measurable points of technical accomplishment and useful alike to both contractor and government management, for the orderly direction of a program's progress. Further, by contractually tying successful accomplishment of milestones in the development contract to release of funds for long-lead time production items, as well as the exercise of production options, demonstration of technical accomplishment will ensure that the program commitment is increased at a pace that is commensurate with the reduction in program risks. Finally, by placing the development/production effort within a contracting envelope that properly recognizes the risk/reward balance, and under the stimulation of appropriate incentives, we aim to avoid many problems that have in the past occurred in acquiring major weapon systems, wherein commitments to production have been made that were inconsistent with the technical risks then remaining in the program.

Excessive Documentation

A continuing problem area is in the matter of documentation. This takes two forms:

- Technical documentation which the contractor is required to provide to the Government in responding to a request for proposal.
- Documentation pertaining to the management of the program by the contractor, if he wins the contract for the development. This includes not only the type of management, but the depth of management detail called for.

There is a growing feeling with respect to the former that not only has the Government been asking for too much depth of detail in the technical documentation, but the contractors frequently have overdone technical documentation on their own initiative, to convince the Government that their depth of knowledge of the system is such that they should be given the contract. We are going to try to stem this tendency toward excess technical documentation.

On the balance, management of our major programs is being accomplished by capable, well educated, highly motivated individuals. The magnitude of these programs, however, causes us not to be fully satisfied with our program management policies and organization. We believe that we probably need better and more extensive training for our program managers, a longer tenure in their jobs for both program managers and other key people in the System Program Offices. Further, a program manager frequently does not have authority to match his responsibility. In some cases, he needs clearer delineation as to what his responsibilities are. In his work he frequently is subjected to such a volume of directives that he cannot possibly be fully familiar and comply with them all. We need high quality, well trained and experienced program managers, with good teams working for them, in a framework of management which permits them to carry out their jobs with a minimum of impediments and extraneous requirements.

One of our major efforts in this connection will be to take a hard look at the composition and the curriculum of the Weapon Systems Management Course at the Defense Weapon Systems Management Center. Possibly the course should be made longer. Perhaps, we should turn out program managers with master's degrees in program management.

In summary, the thrust of our ongoing efforts in the field of defense weapon system acquisition management is this:

The management of defense weapon system acquisition is a titanic task involving the spending of billions of dollars a year covering many programs of a widely divergent nature. It is impossible to find one single policy or method of management which best fits all.

We have tried many methods to get the most defense for each dollar expended. We have made some improvements in the past. More improvements in the future are necessary and planned. We may have overreacted in our handling of some problems. This we would like to avoid in the future. We want to correct and improve the management of our defense weapons system acquisition and do it as prudently as we can, after we are sure we have correctly identified a problem and developed an appropriate solution.

Air Force Systems Management—

Back to the Fundamentals

General James Ferguson, USAF

On the Washington scene, the advent of Vincent Lombardi as head coach of the Redskins has reminded us again that, when things are not going well, the first thing you do is go back to drilling in the fundamentals.

The acquisition of defense weapon systems has likewise not been going as well as it might; or, what is the same thing, it has not *appeared* to be going as well as it should. There are, of course, quite a few reasons. National tension and unrest have been compounding, aggravated by a growing frustration over the war in Southeast Asia, and resulting in a general disenchantment with anything military.

In that kind of climate, any apparent miscue in defense management —in cost, schedule, or performance— triggers a disproportionate avalanche of accusation, recrimination and investigation. These reactions tend to escalate as they are bounced off the walls of the Capitol, reflected on the face of the television tube, and splashed across the news and editorial pages of the printed media.

So we find ourselves the target of a concerted and widespread attack on the sinister-sounding "military/industrial complex."

That being the case, it is certainly time to get back to the *fundamentals* of sound management. The purpose of this article is to trace briefly how we may have gotten away from the fundamentals, how we are now getting back to them, and what the new directions in systems management will mean to the Air Force, the Air Force Systems Command, and the defense contractors.

For background, the Air Force of the 1950s made pretty much of its own systems development and deployment decisions. Program justification was based for the most part on Specific Operational Requirements approved by the Department of the Air Force. In 1955 and 1956, for example, I can recall something like 19 Strategic Air Command programs in the research and development mill; 4 interceptors; 11 applications of nuclear power to ground, aircraft, and space systems; 8 space projects; and all the so-called "L" systems for command, control, and communications. Systems in those days were relatively less sophisticated and, therefore, less costly; and, with the Air Force responsible for about 50 percent of the defense budget, there always seemed to be enough funding flexibility for new programs, as well as for modification and updating of older ones.

In that era, the Office of the Secretary of Defense (OSD) was a small advisory body, with little direct involvement or detailed analysis at that level. Management authority was delegated to the field, and quick decisions with minimum delay were characteristic of systems development. These were the basics, the fundamentals. But it is also quite possible that cost considerations, in those simpler days, were not accorded all the importance they deserved.

In the early 1960s, the national strategy of massive retaliation was overhauled along the lines of flexible response and multiple options. At the same time, exploding technology offered a wealth of options for alternative weapon and support systems—all at a price, of course, and the price was rising rapidly.

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So, given this great range of choices and the tremendous costs of the numerous alternatives, the new Secretary of Defense saw a need for tightened control from the top. The pendulum began a rapid swing in the reverse direction, away from the fundamentals of decentralized management. Mr. McNamara put into operation various control systems and mechanisms—such things, for example, as contract definition, or the quantification of alternative choices through the discipline of systems analysis and the cost/effectiveness ratio, and quite a few others that come readily to mind.

Emergency Measure

In seeking a cohesive allocation of finite resources according to broad roles and missions, these mechanisms and procedures were *fundamentally* sound. Further, if the move to tightly centralized control was a move *away* from the fundamentals, Mr. McNamara recognized that fact and considered the trend to be an emergency measure that could again be reversed. He wrote in 1964:

> **"I strongly believe in the pyramid nature of decision-making and that, within that frame, decision-making should be pushed to the lowest level in the organization that has the ability and information available to apply approved policy."**

In actual practice, however, we moved too far toward the opposite extreme from that of the 1950s. With a plethora of detailed decisions being made at the OSD level, there was a correspondingly massive requirement for detailed information, and for more and more technical people at that level.

This very rapid growth in the Office of the Secretary of Defense caused a parallel technical buildup of large proportions within the Air Staff of Air Force headquarters. There was a mass exodus of many of our best project officers topside, and most of them—with some abetment from the field—took their jobs with them. That left the Air Force Systems Command (AFSC) with a heavy mantle of responsibility but, in reality, short-circuited out of the decision loop by this migration of detailed management to a higher level. Dr. John Foster Jr., Director of Defense Research and Engineering, summed up the situation last summer when he said:

> **"For reasons which are now history, we find the Pentagon today with too much centralization of authority—but not responsibility—too much layering in the decision-making structure, too many reports to be written by people already too busy trying to manage."**

General John P. McConnell, just before retiring as Chief of Staff of the Air Force, put it into down-to-earth terms, and my own experience bears him out. When you are running a flying outfit, as he said, and a squadron commander goofs, you fire him. But in the procurement and development areas, he went on, it is virtually impossible to *find* the right one to fire. Too many people at too many levels have too much to say about the program. Very few of them are empowered to say "Go," while most are authorized to say "No." More likely, they are apt to say "more data" or "restudy."

This is not to say categorically that all of us in the Services were wholly without fault. Speaking for the Air Force, we have realized for some time that, on many occasions, after a virtual Niagara of studies and restudies, we let ourselves be stampeded into contract definition just to finally get going. In frustration, which is perhaps understandable under the circumstances but no less excusable, we have accepted and participated in program decisions without actually having the requisite technology sufficiently well in hand to proceed.

What that sort of thing does to schedules, performance and costs is too well known to require extensive elaboration. A few examples, such as the Short Range Attack Missile (SRAM), the Mark II Avionics, and the Minuteman missile guidance system, are representative. They amply illustrate the need for a far better balance among cost, performance and schedule, *not only* at the very beginnings of the system acquisition cycle, but *all the way through* to the final operational configuration.

New Policy of Decentralization

The new team in Washington has recognized and attacked the problem at the highest levels. President Nixon, with his strong stand on decentralization, has set the tone and furnished the policy framework. He has sent all of us back to the fundamentals. The Defense Department has been taking the necessary steps to get management back where it can truly manage. Dr. Foster has said:

> **"In the Office of the Secretary of Defense . . . you can see a shift toward added emphasis on future defense planning and away from the management of a given program. The senior civilians will require a detailed justification by the Services of a program, but once approved, the Services will run it. The Office of the Secretary of Defense will monitor the program—but hold the Services responsible for the proper conduct of the approved program."**

I am happy to say that the Secretary of the Air Force and the Chief of Staff have expressed their agreement with this return to management fundamentals. Headquarters, U.S. Air Force and AFSC have been actively working with OSD, the Defense Science Board, *and the other Services* on the complex problems of managing huge programs. We have made detailed recommendations along the entire spectrum, and their acceptance is inherent in the new policy that detailed review and the decisions on approved programs will be delegated to the lowest possible level.

AFSC Approach to New Responsibility

Within the Air Force, it would certainly seem to me that AFSC is the logical level. There is no higher level, in fact—in Air Force or Defense Department—at which all the essential ingredients for detailed review and timely decisions come together in clear focus. AFSC, after all, is the organization charged with maintaining the technical and managerial capability for balancing resources against thoroughly analyzed military requirements. At no other level of organization are all these ingredients constantly available for program deci-

sions during the total system procurement cycle.

That fact clearly pinpoints responsibility where it belongs, and AFSC is happy to meet the full challenge. In so doing, I feel that closest attention to the following areas will be essential:

• We are going to have to take a deep and very objective look into the operational capabilities required, and the time frame for their intended use. These considerations will be critical in establishing priorities for future efforts in a climate of curtailed funds and manpower. In this connection, I want to emphasize the tremendous need for judicious *selectivity* among the numerous choices technology dangles before us. As the President has said, "We are living today in a time of great promise—but also too many promises." The trend toward more elaborate frills and increased "gold plating"—which too often turns out to be tarnished when it reaches the field—*must* be reversed.

• We need a more comprehensive understanding of the technology involved and the state of the art available before we charge off into the wild blue. We must have better estimates of technical risks as weighed against performance requirements, costs, and delivery dates.

• We will have to have a flexible scheme of contracting to cover the research and development phases of the program, as well as production. We must recognize the fundamental differences between development and production, and tailor our contracting procedures accordingly.

• We must come up with far more definitive and realistic development schedules than we have done in the past. That means, for one thing, a more realistic use of analytical studies, *prototype development*, and advanced development of components in areas of high technical risk. *And* for another, there must be established definitive decision milestones at which we can assess the impact of problems in technology, costs, performance specifications, and time delays on the comprehensive acquisition schedule.

What all this says is that all our problems must be *visible* and susceptible of solution before a final commitment to production. By placing greater emphasis at the highest level on program approval processes *before* going to production, we assure that everyone—OSD, the Services, Congress, and the contractors—will have a full understanding of just what the base line is for what we are buying. Only with such a base line can we identify our problems and measure our progress against what we set out to do.

With this valid base line—knowing precisely what has really been approved—and with AFSC charged with the proper conduct of the program, we get back to the fundamentals of management, the basic principles. Detailed management information rises only as high as the level at which it is needed and can be useful; spans of control become realistic; and authority is once again wedded to responsibility.

Application to Major Systems Programs

To translate theory into action, the Air Force has been realigning certain functional responsibilities in the program management area. As of July 1969, for example, the F–15 program came under the direct management control of Headquarters, AFSC. The Office of the Assistant for F–15, reporting directly to me, has assumed the functions and responsibilities previously discharged by the Program Element Monitor (PEM) on the Air Staff. Consequently, the appropriate PEM personnel from the Pentagon have been transferred to AFSC headquarters at Andrews AFB, Md.

At the same time, the F–15 System Program Director, who formerly reported through the Commander of the Aeronautical Systems Division (ASD), now reports directly to me. He will, however, remain at ASD headquarters, Wright-Patterson AFB, Ohio.

The same type of organizational structure and alignment of responsibilities is also under consideration for the B–1 advanced bomber program. We anticipate going the same route for selected major programs of the future, once they have been approved for development and acquisition.

Meanwhile, other programs already under way are also candidates for a close tie-in to AFSC. This entails a shift of many of the Air Staff PEM functions to the appropriate AFSC staff agency as the focal point for detailed management information. Finally, we are considering much the same sort of process with regard to various advanced development programs.

I have discussed these changes in great detail with the System Program Directors (SPDs) directly affected, and charged them with surfacing problems and getting them to me as soon as they appear. The SPDs will thus be giving me detailed reports; emerging problems will be identified and resolved before they grow malignant and multiply out of control. Also, we will be paying very strict attention to costs, schedules, performance, and program decision requirements.

This in no way portends that we are trying to cut the higher levels out of the loop once they have approved a program. Rather, the purpose is to eliminate unnecessary briefing and reporting at all levels. We all realize that each level of organization must have the information necessary to fulfill its management responsibilities; but we also know we have to get rid of the study and restudy requirements from various staffs, offices, committees, and other reviewing agencies that have neither the authority nor the responsibility for program decisions.

In conjunction with the other Services, we are developing a standardized format with which we, in turn, report to higher levels. In my own case, for example, I will be highlighting problems of our major programs for the Secretary of the Air Force, the Chief of Staff, and OSD in a quarterly review—without the need for these higher levels to constantly review and drown in a flood of complex detail.

Thus, AFSC should become the Air Force focal point, in Washington, for comprehensive program management information. We will, as a result, be able to respond fully to the Secretary and the Chief of Staff, as well as to OSD levels; and these higher levels, in turn, can be responsive to the Congress through the System Acquisition Reports.

With these steps being taken to remedy genuine deficiencies—to get back to the fundamentals of systems management—it is not difficult to deduce the probable impact on our defense contractors. The controlling factor, obviously, is the real squeeze

on money and manpower that we can expect for at least the next few years —and very probably beyond. The necessity for the Services to get a great deal more value from every research and development and production dollar cannot help but have a profound effect on the industry.

Effect on Defense Contractor

For one thing, our look at past performance, as a factor in source selection, is going to be far deeper, more penetrating, and far more realistic.

"Realism," in fact, is going to be the operative environment. There will, in the future, be very scant likelihood of low-cost buy-ins, or of our accepting performance specifications beyond those in the original definition, at the price of disproportionate cost increases.

We are going to be particularly resistant to Engineering Change Proposals (ECPs) for increased performance, whether they come from the contractor *or* the user. Any ECP is going to be looked at through a jaundiced eye, first to see if there is any real need for it at all and, second, if it passes that test, to determine what it would do to costs and schedules.

I think it would be reasonable to expect a definite move in the direction of hardware verification—prototyping —as a complement to the present flood of paper studies in the contract definition phase. I think of this as competitive "initial development" or, in effect, a "contract definition in hardware." After all, brochures *always* perform beautifully, but I frankly prefer—when it is at all possible—to see a piece of hardware proving *what* it can do, *when* it can probably be delivered, and *whether* it is worth the money it will cost. In this connection, we will be using all available techniques, including exploratory and advanced development, to validate system feasibility. We *must* ensure that we have a viable program *before* we commit ourselves to the major costs of development and production.

All in all, I would say, we can expect for the foreseeable future a trend to the very basic "necessities of life," at realistic and thoroughly justifiable price tags.

To sum up, AFSC analytical capability applied to Air Force mission requirements, added to the command's technical competence, together form a potential for producing the best and most advanced weapon systems in the world. When you add, as is now being done, the management authority necessary to really *control* your programs, that potential is much more likely to translate into reality. With these three ingredients—analysis, technology, and authority—working together with industry, we will be able to produce viable weapon systems that meet the nation's needs as fully as they can be met, are no more complex than they need to be to fulfill their functions, and are priced as close to their true worth as human effort can manage.

The Air Force, as I have described, is taking major constructive steps to remedy deficiencies that we ourselves have recognized for some time.

For our part, the Air Force Systems Command is definitely off and running, doing exactly what the highest levels of Government—and we ourselves—have all agreed should be done. We have, in short, gone back to the fundamentals.

Army Advisors to NASA for FY 1970 Named

Appointments of Army members of advisory committees to the National Aeronautics and Space Administration for FY 1970 have been announced.

Assistant Secretary of the Army, Research and Development, Charles L. Poor was chosen for another term on the Committee on Aeronautics; and Paul Yaggy, Director of the Army Aeronautical Laboratory, Moffett Field, Calif., was reappointed to the Subcommittee on Aircraft Aerodynamics.

Richard L. Ballard, of the Physical and Engineering Sciences Division, Army Research Office, was selected to serve on the Subcommittee for Aircraft Structures.

Richard T. Alpaugh, Chief of the Aircraft Power Section, Army Materiel Command (AMC), was named to the Subcommittee on Airbreathing Propulsion; Colonel Harry Jones, Chief, AMC Air Mobility Division, was appointed to the Subcommittee on Aircraft Operating Problems; and Hyman Rosenthal, adviser in the Mettallurgy Research Laboratory, Frankford Arsenal, is on the Panel on Materials for Aircraft Engines.

DOD Standardization Documents Available

Orders for specifications and standards are accepted by the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pa. 19120. Requestors should use DD Form 1425, if available, and should provide name, address, contract number, quantity, and specification and standard document number. Telephone orders are also accepted; phone (215) 697-3321.

More detailed information on obtaining copies of these documents is published in a "Guide for Private Industry," available from the Naval Publications and Forms Center.

The Defense Department Index of Specifications and Standards (DODISS), covering unclassified military and Federal specifications and standards published by the Naval Publications and Forms Center, is available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

A two-part publication, with alphabetic and numeric listings, DODISS is available in the United States at the annual subscription rate of $22. A listing by Federal Supply Classification is also available, at $12 per year.

B-1 Requests for Proposal Issued

Requests for Proposal (RFP) for the development of the B-1 strategic aircraft have been issued by the Air Force. Proposals are to be submitted to the Air Force by spring 1970 for evaluation, with awarding of engineering development contracts to follow.

Airframe RFPs went to North American Rockwell Corp., Los Angeles, Calif.; General Dynamics Corp., Fort Worth, Tex.; The Boeing Co., Seattle, Wash.; and Lockheed Georgia Co., Marietta, Ga. Engine RFPs were sent to Pratt and Whitney Co., Hartford, Conn.; and General Electric Co., Evendale, Ohio.

The B-1 is seen as the possible replacement aircraft for the B-52 in the Strategic Air Command's inventory. Formerly called the Advanced Manned Strategic Aircraft (AMSA), it would be capable of supersonic speeds.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Philip A. Odeen has been appointed Dep. Asst. Secretary of Defense (Regional Programs) in the Office of the Asst. Secretary of Defense (Systems Analysis). This is a new position combining two Dep. Asst. Secretaryships, Regional Forces Programs and Southeast Asia Programs, which have been abolished. Mr. Odeen formerly served as Dir. of Southeast Asia Resources Div. in the Systems Analysis Office.

John H. Morse has been designated Dep. Asst. Secretary of Defense (European and NATO Affairs) in the Office of the Asst. Secretary of Defense (International Security Affairs).

Dr. George C. S. Benson, who has been Dir. of ROTC Programs reporting directly to the Asst. Secretary of Defense (Manpower and Reserve Affairs), has been appointed Dep. Asst. Secretary of Defense (Education). **Dr. Nathan Brodsky**, who has been Acting Dep. Asst. Secretary, will continue to serve in his regular capacity as Dir. of Education Programs and Management Training, and will be Principal Deputy to Dr. Benson.

VAdm. Harold G. Bowen, USN, has been assigned to the Office of the Asst. Secretary of Defense (Administration) as Dep. Asst. Secretary of Defense (Intelligence).

New Commander of the Defense Supply Agency's Defense Fuel Supply Center, Aexandria, Va., is **Maj. Gen. Charles C. Case, USA.** He succeeds **RAdm. Fowler W. Martin Jr., SC, USN**, now Commander, Defense Electronics Supply Center, Dayton, Ohio, replacing **Brig. Gen. Glen J. McClernon, USAF**, who retired on Nov. 1.

DEPARTMENT OF THE ARMY

Brig. Gen. Winant Sidle, who has for the past two years served in Vietnam first as Chief of Information for the U. S. Military Assistance Command, Vietnam, and later as Commanding General, I Field Force Artillery, is the new Chief of Information for the Department of the Army.

New personnel assignments made in the Army Materiel Command are:

Maj. Gen. John R. Guthrie, Dir., Research, Development and Engineering, Hq., AMC; **Maj. Gen. John L. Klingenhagen**, Commanding General, Army Aviation Systems Command, St. Louis, Mo.; **Brig. Gen. Edwin I. Donley**, Commanding General, Army Missile Command, Redstone Arsenal, Ala.; **Brig. Gen. George M. Bush**, Commanding General, Army Mobility Equipment Command, St. Louis, Mo.; **Brig. Gen. (designee) Alvin C. Isaacs**, Dep. Commanding General, Army Tank-Automotive Command, Rock Island Arsenal, Ill.; **Col. William D. Meara**, Dep. Commander, Aberdeen Proving Ground, Md.; **Col. Eugene W. McGinnis**, Chief of Staff, Army Missile Command, Redstone Arsenal, Ala.; **Col. John R. Adie**, Commander, Army Aviation Materiel Laboratories, Ft. Eustis, Va.; and **Col. Vitaly Kovalevsky**, Dir., Infantry Materiel Testing, Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

Recent staff assignments in the Office of the Chief of Research and Development (OCRD) include: **Col. Raymond L. Martin**, Chief, Communications-Electronics Div., and **Col. Joseph B. Love**, Dep. Dir., Plans and Programs. Also under OCRD, **Lt. Col. George G. Tucker Jr.**, Commanding Officer, U. S. Army Research Office-Durham, Durham, N. C., replacing **Col. Donovan F. Burton** who has retired; and **Col. Rudolph A. Axelson**, Commanding Officer, Army Limited War Laboratory, Aberdeen Proving Ground, Md.

Brig. Gen. (designee) Thomas W. Brown assumed command of the Army Combat Developments Command Experimentation Command, Ft. Ord, Calif., on Dec. 15; and **Brig. Gen. (designee) Edward B. Kitchens Jr.** is the new Commanding General, Combat Arms Group, Combat Developments Command, Ft. Leavenworth, Kan.

Col. Avery S. Fullerton has been assigned District Engineer for the Jacksonville (Fla.) District of the Army Corps of Engineers.

DEPARTMENT OF THE NAVY

In the Office of the Chief of Naval Operations, **RAdm. Jerome H. King Jr.** has been designated Dir., Ship Characteristics Div. and Chairman, Ship Characteristics Board; and **RAdm. (designee) James W. Nance** has been assigned as Asst. Dir., Strategic Plans Div.

RAdm. Kent L. Lee is the new Asst. Commander for Logistics and Fleet Support, Naval Air Systems Command, Washington, D. C.

Capt. Richard E. Jortberg has been assigned to the Deep Submergence Systems Project Office, 6900 Wisconsin Ave., Chevy Chase, Md., as Special Projects Officer.

Capt. Henry D. Arnold has been designated Executive Asst. to the Asst. Secretary of the Navy (Research and Development).

New Commander, Midwest Div., Naval Facilities Engineering Command, Great Lakes, Ill., is **Capt. Joseph W. Gorman.**

Capt. Robert Ennis has been assigned Asst. Commander, Naval Ordnance Laboratory, White Oak, Md.

DEPARTMENT OF THE AIR FORCE

Maj. Gen. Joseph S. Bleymaier, Dep. Dir., MOL Program, Office of the Secretary of the Air Force, (located at Los Angeles, Calif.) has retired.

Brig. Gen. Richard L. Ault is the new Asst. to the Dir. of Plans, Office of the Dep. Chief of Staff, Plans and Operations, Hq., USAF. He replaces **Brig. Gen. Charles W. Lenfest** who has retired.

In the Air Force Systems Command, **Brig. Gen. Guy M. Townsend** has been reassigned from Dep. for Systems Management to Systems Program Dir. for the B-1 aircraft program at the Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

Research and Development Information for Industry

Lieutenant Colonel John A. Shanahan, USA

Mindful of the importance of the contribution by industry to the solution of the U.S. Army's future materiel needs, the Chief of Research and Development has established three broad means to provide timely, authoritative planning information to industry. These are: advanced planning briefings and symposia; provision of significant documents to industry; and information provided by the Army industrial liaison offices located at all major Army development commands (see Figure 1).

The ultimate objective of Army research and development is weapons, equipment and techniques qualitatively superior to those of any potential enemy. The Army recognizes it must keep industry informed of long-range research and development plans concerning future materiel requirements and objectives, so that industry can properly respond.

Sources of Information

The Army research and development program is the result of considerable study and planning, an attempt to chart a course 20 years into the future. Long-range planning guidance for research and development is found in several Department of the Army planning documents. These contain organizational, operational and materiel concepts for the next 20 years. In addition, technological forecasts are prepared for the same 20-year period. Because of their sensitive nature, none of these documents are distributed to industry, although the research and development implications are found in other documents that are available for review.

The Army Research Plan guides research and exploratory development and is the vehicle for planning courses of action leading to advances in the scientific and technological base. It must support the desired operational capabilities that are derived from the Army Concept Program.

Combat Development Objectives Guide contains information on long-range plans developed by the U.S. Army Combat Developments Command. This document states future Army requirements. Commonly called the CDOG, it contains six types of entries that directly concern Army research and development:

- General Objectives.
- Operational Capability Objectives.
- Qualitative Materiel Development Objectives.
- Advanced Development Objectives.
- Qualitative Materiel Requirements.
- Small Development Requirements.

A Qualitative Materiel Development Objective (QMDO) states that a need exists for a certain kind of equipment, materiel, or system, but that the feasibility of successful development is not known, and research and/or exploratory development are still necessary. Specific detailed descriptions are not included in these entries since they do not lend themselves to this kind of definition.

An Advanced Development Objective (ADO) is a statement of military needs, approved by the Department of the Army, for development of items for experimental or operational test, in order to clarify cost, operational

Lieutenant Colonel John A. Shanahan, USA, is assigned to the Industrial Liaison Branch, Technical and Industrial Liaison Office, Office of the Chief of Research and Development. He is a graduate of the Army Command and General Staff College and the National Security Management Course of the Industrial College of the Armed Forces. He holds a bachelor of general education degree from the University of Omaha, Neb.

and/or technological factors prior to commencing engineering development.

The Qualitative Materiel Requirement (QMR) differs from the QMDO in that the technical and scientific feasibility of developing the items or systems is known, or, as it is sometimes stated, development is within the state of the art or soon will be. The QMR is more specific in its definition and description of what it required. The QMR guides engineering development of an item for Service use.

A Small Development Requirement (SDR) is a statement of a need for a piece of equipment that is not complex or expensive enough to warrant formal establishment of a QMR. SDRs are published as an appendix to CDOG. They have the same effect as a QMR with regard to authorization for a program. The difference lies in the size, cost and developmental lead time of the items or systems envisioned, and in the probability that SDRs can be achieved with fewer reviews and studies.

Research and Development Planning Summary (DD Form 1634 which is replacing DD Form 1498) contains research and development progress information, including the location where the work is being accomplished and the individual responsible for the project or task.

Who May See Long Range Planning Documents?

Representatives of qualified industrial, scientific, or other civilian organizations may see specific portions of these documents when a clear "need-to-know" has been established. The Office of the Chief of Research and Development, Department of the Army, determines "need-to-know" after examining the limits of the organization's expressed areas of interest, evaluating the research and development capabilities of the organization, and considering the Army's need for civilian participation in the research and development efforts within these areas of interest.

A qualified potential recipient of research and development information is a U.S. citizen, firm, partnership, corporations, or other type civilian organization which has:

- Expressed a desire to participate in the research and development effort of the Army.
- Obtained the required industrial personnel and facility security clearances.
- Provided acceptable evidence of a research and development capability in being. In cases where the organization's area of interest exceeds its capability in being, it must provide acceptable evidence of a realistic and feasible intent to expand the capability adequately.

Where Can Documents Be Seen?

Planning documents can be reviewed daily by qualified industry representatives at the Technical and Industry Liaison Office (TILO), Office of the Chief of Research and Development, located in Room 3D380, The Pentagon. Companies may schedule a reading room for a half day, or a full

U.S. Army Points of Contact for Research and Development Plans

U.S. Army Combat Developments Command
ATTN: CDCCS-RI Col. J. W. Ryan
Ft. Belvoir, Va. 22060
Phone: (703) 664-6766

U.S. Army Combat Developments Command
West Coast Liaison Office
Suite 204 Lt. Col. Alfred J. Spaulding
8816 Sepulveda Blvd.
Los Angeles, Cal. 90045
Phone: (213) 645-4735

U.S. Army Materiel Command
ATTN: AMCRD-PS-TILO John Konopka
Washington, D.C. 20315
Phone: (202) OX 5-3127

U.S. Army Munitions Command
ATTN: AMSMU-RE-P George Watson
Dover, N.J. 07801
Phone: (201) 328-2174

U.S. Army Electronics Command
ATTN: AMSEL-S Jack Mannix
Ft. Monmouth, N.J. 07703
Phone: (201) 535-2240

U.S. Army Tank-Automotive Command
ATTN: AMSTA-RR-F Edward Mackiewicz
Warren, Mich. 48090
Phone: (313) 756-1000 Ext 35242

U.S. Army Weapons Command
ATTN: AMSWE-REF Hugh Saunders
Rock Island, Ill. 61202
Phone: (309) 794-6001 Ext. 5157

U.S. Army Missile Command
ATTN: AMSMI-RFE Julian S. Kobler
Redstone Arsenal, Ala. 35809
Phone: (205) 876-2722

U.S. Army Aviation Systems Command
ATTN: AMSAV-GL(AMR) Eric Peterson
St. Louis, Mo. 63166
Phone: (314) 268-2045

U.S. Army Mobility Equipment
Research and Development Center
ATTN: SMEFB-RDE-O Hyman Graus
Ft. Belvoir, Va. 22060
Phone: (703) 664-5120

Figure 1.

COMPANY LETTERHEAD

Chief of Research and Development
Department of the Army
ATTN: Security Officer
Washington, D.C. 20310

Reference: DOD Industrial Security Regulation 5220.22-R, paragraph 3-201b.

In accordance with reference, approval is requested for the following employees to visit your facility:

Full Name Job title	Clearance, date issued	Date, place of birth

Purpose of visit: To visit TILO.

Dates of visit:

Person to be contacted: (In Army, if known.)

Statement of facility clearance: XYZ Corp. has a (type of clearance) facility clearance granted on (date) by (granting agency).

I certify that clearance information set forth above is correct.

Approval for this visit is assumed, unless information to the contrary is received.

Cognizant security office for the corporation is (name of DCASR or other office).

I. M. Secure
Security Officer

Figure 2.

day on the first visit. Three briefing rooms give the TILO capacity to accommodate up to six industrial representatives a day.

Companies must make appointments at least two weeks in advance. The aforementioned requirements for qualification and a statement of specific areas of interest must be made in writing to:

Chief of Research and Development
Department of the Army
ATTN: Chief, Technical and Industrial Liaison Office
Washington, D.C. 20310

At the same time, a visit authorization request must be sent to:

Chief of Research and Development
Department of the Army
ATTN: Security Control Officer
Washington, D.C. 20310

The two-week lead time is important for the visit authorization request. This time is needed for mailing and processing. Information to be included in the visit authorization request is shown in Figure 2.

The request for visit may be made to cover a one-year period. This is provided for in DOD Industrial Security Regulation 5220.22-R, paragraph 3-201b. This reference should be noted on the request for visit. The request should be annotated to indicate that the individual representative has been designated by his company as an authorized messenger for transmission of classified material. The request should also be annotated with the phrase, "To visit TILO."

For further information, contact the Chief, Technical and Industrial Liaison Office, at address given previously, or by telephone: (202) OX 5-6496 or OX 5-6471.

SCAD Program Office Established at ASD

The Air Force Systems Command has established a System Program Office for a proposed decoy missile at the Aeronautical Systems Division's Deputate for Development Planning, Wright-Patterson AFB, Ohio.

The missile, called the Subsonic Cruise Armed Decoy (SCAD), is designed to be launched from strategic bombers singly or in multiples.

Study contracts for SCAD have already been awarded by the Air Force. Systems design contracts went to Beech Aircraft Co., Wichita, Kan.; The Boeing Co., Seattle, Wash.; and Lockheed Missile and Space Co., Sunnyvale, Calif. The high-energy fuel study contract went to AiResearch Manufacturing Co., Garret Corp., Phoenix, Ariz.; and the contract for the decoy system study was awarded to the Cornell Aeronautical Laboratory, Buffalo, N.Y.

USAF Sets Up Mallard Detachment

The Air Force Systems Command's Electronic Systems Division has established Detachment 13, located near Ft. Monmouth, N.J., as the Air Force's command authority for personnel assigned to the Mallard Project. Responsibilities include assisting in Mallard system design, development and management.

Mallard is a U.S. joint Services and international project to design, develop and procure a tactical communications system satisfying combat zone requirements.

Colonel Clifton L. Nicholson is commander of Detachment 13.

Logistic Manager of Wide Variety of Military Items and Equipment

Brigadier General John D. Hines, USA

Imagine the Great Wall of China made of sandbags—a wall 25 feet wide at the top, stretching 225 miles. Or, just imagine 1,353,410,000 sandbags. The Defense General Supply Center, Richmond, Va., has procured that number of sandbags since 1965.

A field activity of the Defense Supply Agency (DSA), the Defense General Supply Center (DGSC) is one of the six commodity-oriented centers which provide logistic support primarily to the Military Services. The DGSC general supply management responsibility ranges from mess kits to infrared aerial film, from kitchen equipment to airfield lighting equipment, from school and library supplies to the chaplain's wine, from antifreeze to compressed gas. Many of the items, for which the center is responsible, support 32 primary military weapon systems. DGSC catalogs about 300,000 items.

The mission of DGSC consists of the following assignments:

- To organize, direct and control the supply management functions in assigned military supplies for the Defense Department.
- To receive, store, care for and preserve, and ship material under DGSC management.
- To supply management of the civil defense needs of the United States.
- To procure school supplies and library material for overseas dependent schools and to procure non-Federal stock numbered books and publications for continental U. S. and overseas activities.
- To supply management of general-type, chemical and packaged fuel items for the Armed Services. This function is the largest in DGSC's mission.

Organization

The Defense General Supply Center organization consists of six staff elements and five directorates. The Office of Planning and Management is the principal staff advisor and assistant to the commander in directing the execution of policies relating to plans, programs, review and analysis, systems and procedures, management analysis and engineering, and manpower control. The Office of the Comptroller is the principal advisor on financial and budgetary management matters, and the Office of Data Systems supports the logistic responsibilities of DGSC and tenant activities. The remaining offices include civilian personnel, counsel, and the personal staff, the latter consisting of the small business specialist, public affairs officer, and the military personnel officer.

The five directorates include Storage and Transportation, Installation Services, Supply Operations, Procurement and Production, and Technical Operations. Storage and Transportation is responsible for the receipt, storage, transportation and issue of material at Richmond. Installation Services conducts the administrative, housekeeping and property disposal functions of the installation. The Directorates of Supply Operations, Procurement and Production,

Brigadier General John D. Hines, USA, is Commander, Defense General Supply Center. Prior to this command, he served as Commander, Defense Industrial Supply Center, Philadelphia, Pa., and Commander, Army and Air Force European Exchange System.

and Technical Operations are the activities which perform nationwide supply management of general type, chemical and packaged fuel items for the Services.

Supply Operations

Inventory management is exercised over more than 100,000 stocked items, from the mundane to the sophisticated. Because the variety of materials managed do not have similar control characteristics, *i.e.*, shelf life, commercial availability, cost or weapon system essentiality, different management techniques are employed for the various categories of items. To fill the more than 1.8 million annual requests for material, DGSC's inventory is stored in large wholesale distribution depots throughout the continental United States, and keeping depot inventories at required levels is the job of the Directorate of Supply Operations.

The directorate's commodity analysts can be likened to "buyers" in private industry, as they determine "what," "how much," "where" and "when." (Actual procurement and contracting responsibilities, however, are assigned to the Directorate of Procurement and Production.)

Inventories are constantly analyzed and evaluated quantitatively, qualitatively and financially. The algebraic sum of forecasted requirements is compared with inventory assets and the result is the command budget. After review at DSA headquarters and higher levels of authority, a funding program is allotted. The Directorate of Supply Operations schedules procurement in a manner that optimizes use of funds and inventory requirements.

In addition to support of normal requests for material, the directorate is responsible for the acquisition and positioning of various reserve inventories for war or other operational emergencies. It supports the civil defense mission of the Defense Department. This involves inventory management, storage and issue of survival supplies for stocking fallout shelters, as well as similar management of radiological defense instruments and disaster relief type engineering equipment. Technical assistance is provided with regard to radiological and engineering equipment.

DGSC Distribution Activity

The Directorate of Supply Operations handles DGSC's distribution network. From the point at which an item enters the distribution system, until it is sent to the requisitioner, the directorate provides instructions on its travel.

DGSC is linked to an automatic, electronic high-speed data communications switching network which provides a high-capacity means of exchanging data with the Services and the entire DSA supply system. Over this network, by means of either punch card or magnetic tape, the Military Service requisitioner sends his request for supplies directly to Richmond, ready for processing by the DGSC computer operation.

In many cases, the computer determines where the necessary supplies are stored, considers factors such as location of the requisitioner, and automatically selects the most logical site in the DGSC distribution system from which shipment can be made. Then, over the communications network, the computer instructs the specific site to ship supplies to the requisitioner.

The automatic data processing equipment and the communications system also permit better application of other management techniques in the directorate's supply operation.

The continuing materiel management study provides information giving a complete record on each item, the item's stock balance, and where the item is stored, which is programmed into the computer. The computer then indicates when the stock reaches the reorder point, or it can carry the automation one step further. When the reorder point of the item is reached, the computer compiles all necessary data, records all changes on tape, and then automatically prints out the purchase request, including previous buy history, item description and technical data required to support the procurement.

A second method, adopted to keep DGSC abreast of contemporary military logistics, is the economic quantity principle, by which procurement is compared against storage, and stock quantity is determined by the most economical buy.

In an effort to give requisitioners the best possible service, DGSC established an Emergency Supply Operations Center (ESOC). ESOC is equipped with a special telecommunications system, and is staffed 24 hours a day, ready to give attention to high-priority requisitions.

Procurement and Production

The Directorate of Procurement and Production processes procurement directives, developed by the Directorate of Supply Operations, through the bid and award procedures, and executes contracts with manufacturers or suppliers. In addition to DGSC-managed items, the directorate purchases supplies to fulfill DGSC's educational supply mission, and buys for the Military Services under a DOD-coordinated procurement program. The directorate accounts for and controls center-owned property in the hands of contractors and government plants.

During FY 1968, procurements at the center totaled \$511.5 million. The figure for FY 1969 was down, totaling \$436 million. Another statistic to illustrate the directorate's procurement rate is that every 60 seconds of every working day a contract is executed, and every 20 seconds DGSC purchases an industry item.

Last year DGSC purchased 216 million pounds of aluminum powder, totaling approximately \$75 million. This was enough powder to make 288 million rolls of aluminum foil, or about six 25-yard rolls for every family in the United States. From Dec. 1, 1967, to Nov. 30, 1968, DGSC purchased 8 million library books, worth approximately \$3.5 million. Also, last year the center purchased \$50 million in photo supplies.

The directorate's Special Purchase Division, or SPUR, deals with nonstandard or non-stocked items related to general supply material. Approximately 90 percent of the SPUR-purchased items are under \$2,500, and last year 85,889 purchases were made by SPUR.

Technical Operations

The Directorate of Technical Operations develops, publishes and maintains the DOD section of the Federal Supply Catalog for military general supplies. Through standardization and simplification projects, it conducts continuous item reduction programs, and furnishes guidance for substituting and interchanging items.

DEFENSE GENERAL SUPPLY CENTER

RICHMOND, VIRGINIA 23219

PHONE (703) 275-3861

Editor's Note: Organization charts appearing in the Bulletin are edited by the editorial staff to reflect those elements of the various DoD organizations which are of interest to industry representatives. Organizational elements not involved in the DoD-industry relationship have been eliminated because of space limitation.

The information on personnel and telephone numbers is as current as is possible to obtain at the time we go to press.

OFFICE OF THE COMMANDER

COMMANDER
BRIGADIER GENERAL J D Hines, USA — 3300

DEPUTY COMMANDER
CAPTAIN T H Dawson, USN — 3200

EXECUTIVE OFFICER
MAJOR D L Hancock, USAF — 3535

PERSONAL STAFF

PUBLIC AFFAIRS OFFICER
MR. J P Smith — 3139

SMALL BUSINESS SPECIALIST
MR. W R Randolph — 3617

OFFICE OF PLANNING & MANAGEMENT

DIRECTOR, COL E P George, USAF — 4361/3392
DEPUTY DIRECTOR, MR. L Eisen — 4361/3397

MANAGEMENT CONTROL DIV
CHIEF, CDR F E Malone, USN — 3234

SYSTEMS & PROCEDURES DIV
CHIEF, MR. N E Meador — 3508

PLANS, PROGRAMS & ANALYSIS DIV
CHIEF, LTC S Milliner, USA — 3795

SAMMS TASK FORCE
PROJ OFF, MR. N H Meloche — 4474

OFFICE OF COMPTROLLER

COMPTROLLER, MR. N M Russell — 4194/3227
DEPUTY COMPTROLLER, MAJ G B Adams, USA — 3227/4194

ACCOUNTING & FINANCE DIV
ACTING CHIEF, MR. M E Smith — 3312/3112

BUDGET DIV
CHIEF, MR. W S Boggess — 3928/3014

PERFORMANCE ANALYSIS & REPORTS DIV
CHIEF, MR. R R Willis — 4603/3207

OFFICE OF DATA SYSTEMS

DIRECTOR, COL W E Brett, USA — 3735/4423
DEPUTY DIRECTOR, MR. H Tenenbaum — 4423/3735

MANAGEMENT SUPPORT OFC
CHIEF, MR. J C Pepper — 4228/3091

SYSTEMS DESIGN & PROGRAMMING DIV
CHIEF, MAJ W P Barnody, USAF — 3423/3516

OPERATIONS DIV
CHIEF, CDR H C Dickson, Jr, USN — 3123/3591

OFFICE OF COUNSEL

COUNSEL, MR. J G Trowe — 3211/4152
DEPUTY COUNSEL, MR. F N Jones — 4152

DIRECTOR OF SUPPLY OPERATIONS

DIRECTOR, CAPT J A Rehberg, USN — 3230/4463
DEPUTY DIRECTOR, MR. J E Witt — 3230/4463

MANAGEMENT SUPPORT OFC
CHIEF, LTC H G Pohler, USA — 4277/3109

INVENTORY MANAGEMENT DIV I
CHIEF, LTC J J Helicky, Jr, USMC — 4322/4570

INVENTORY MANAGEMENT DIV II
CHIEF, LTC R L Gordon, Jr, USA — 4261/4464

STOCK CONTROL DIV
CHIEF, CDR D C Metaffey, USN — 4520/4253

CIVIL DEFENSE DIV
CHIEF, MR. R C Kershaw — 4554

DIRECTOR OF PROCUREMENT & PRODUCTION

DIRECTOR, COL E J Bartlett, USAF — 3305/4244
DEPUTY DIRECTOR, MR. T C Simpson — 4244/3305

CONTRACT REVIEW OFC
CHIEF, MR. W S Gorski — 4823/3574

MANAGEMENT SUPPORT OFC
CHIEF, LTC C M Edmonds, USAF — 4351/4253

OPERATIONS SUPPORT OFC
ACTING CHIEF, MR. W B Smith — 3372/4257

PRODUCTION DIV
CHIEF, LTC L C Jones, USA — 3961/3591

PROCUREMENT DIV I
CHIEF, LTC D D Christian, USA — 3037/4525

PROCUREMENT DIV II
CHIEF, LTC P L Clark, USA — 3926/3410

DIRECTOR OF TECHNICAL OPERATIONS

DIRECTOR, COL J C McWhorter, Jr, USA — 3841
DEPUTY DIRECTOR, MR. F R Thomas — 3841

TECHNICAL SERVICES DIV
CHIEF, LTC J A Frederick, USAF — 4409

TECHNICAL DATA DIV
CHIEF, MR. W G Tippett — 4135

CATALOGING DIV
CHIEF, MR. J E Poland — 3180

QUALITY ASSURANCE DIV
CHIEF, LTC M G Crosby, USAF — 4322

MANAGEMENT SUPPORT OFC
CHIEF, LT R D Gent, USN — 3177

STANDARDIZATION OFC
CHIEF, MR. H L Ross — 3333

PROVISIONING COORDINATION OFC
CHIEF, MR. E L Kessel — 4407

DIRECTOR OF INSTALLATION SERVICES

DIRECTOR, COL C L Sitter, USMC — 3222/3461
DEPUTY DIRECTOR, MR. B T Walker — 3222/3461

EASTERN REGION TELECOMMUNICATIONS
CHIEF, MR. T N Myers — 3817

OFC OF SAFETY & INDUSTRIAL HEALTH
CHIEF, MR. W L Lancaster — 3187

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CHIEF, MAJ J E Bock, USA — 3217

TELECOMMUNICATIONS DIV
CHIEF, CAPT J C Thomas, USAF — 3226
ASST CHIEF, MR. R W Bendelback — 3328

OPERATING MATERIEL DIV
CHIEF, CDR G W Cook, USN — 3415

CIVIL ENGINEERING DIV
CHIEF, LTC G K Belden, USA — 3910/3915

PROPERTY DISPOSAL DIV
CHIEF, MR. J J Lyden — 3327

DIRECTOR OF STORAGE & TRANSPORTATION

DIRECTOR, COL S Dachel, USA — 4664
DEPUTY DIRECTOR, MR. R E Myers — 3352

MANAGEMENT SUPPORT OFC
CHIEF, LTC J W Larkin, USAF — 3496

OPERATIONS CONTROL OFC
CHIEF, MAJ L E Hofmann, USAF — 4233

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CHIEF, LCDR J R Weaver, USN — 3012

SHIPPING DIV
CHIEF - VACANT — 4447

RECEIVING DIV
CHIEF, MR H W Sallewright, Jr — 4509

TRANSPORTATION & TRAFFIC MGT OFC
CHIEF, MAJ J B Barton, USA — 3303

The directorate is primarily concerned with carrying out the DSA quality and reliability policies and procedures for the center. In performing these tasks, the directorate has three functions: laboratory management, including product listing procedure and sources for their accomplishment, and monitoring testing of field-submitted samples by government laboratories; liaison with field inspection personnel; and providing necessary quality assurance support to other elements of DGSC, DSA, storage and maintenance sites, and contracting officers.

Value Engineering

One of the directorate's responsibilities is DGSC's value engineering program. A two-phase program, it has the goal of reducing the cost of the defense budget through the use of value engineering procedures and techniques.

The first phase of the DGSC value engineering program is the in-house effort to review, investigate, and develop and coordinate ideas for reducing the procurement cost of items for which DGSC has management and procurement responsibility.

The second phase is the responsibility to promote and increase the emphasis of government contractor participation in the incentive portions of the program though Value Engineering Change Proposals.

Although the DSA supply centers have logistic management responsibilities for the items they procure, the Services retain the prerogative to develop the technical requirements of the items they use. This means that, upon receiving a Value Engineering Change Proposal or Engineering Change Proposal from a manufacturer on a given contractual requirement, the DGSC procurement contracting officer, in administering the procurement, must coordinate and receive acceptance or rejection from the engineering support activity within the Service responsible for the item. DGSC assistance in this area can result in savings of time and money for both the contractor and the Government.

Value engineering, coupled with industrial know-how, can increase profits and decrease defense spending. Past experience has shown that value engineering actions have also resulted in product improvement, through the use of the latest state-of-the-art advances.

From value engineering to computer-process requisitioning, DGSC is aiming at DSA objectives of effective logistic support for our operating forces, cost reductions to "stretch" tax dollars, and efficient contract administration services in support of defense contractors.

PALLETIZED SANDBAGS ready for shipment overseas. Since 1965, the Defense General Supply Center has purchased more than 1.3 billion sandbags, valued at more than $301 million.

ESD Establishes New Deputate for Computers

[Editor's Note: Readers may wish to add this new deputate to the organization chart of ESD, published in the *Defense Industry Bulletin*, Dec. 1969, page 3.]

A major reorganization of the Air Force Systems Command's Electronic Systems Division (ESD), L.G. Hanscom Field, Mass., has been announced. The creation of a new Deputy for Command and Management Systems was made to centralize ESD's computer-based activities.

Included in the new deputate are: the Electronic Data Processing Equipment Office, responsible for all Air Force management-type computer purchasing; the portion of the Space Defense and Command Systems Program Office dealing with acquisition of command systems; portions of the Directorate of Planning and Technology involved in command system design and development; and the Air Force computers located at Hanscom Field.

Several factors influenced the establishment of the new deputate, including the requirements for major updates of existing equipment to meet future needs; standardization requirements in the design, acquisition and integration of systems; and the opportunity for improvements through new technology.

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RESEARCH REPORTS

Organizations registered for service may obtain microfiche copies of these documents without charge from:

Defense Documentation Center
Cameron Station
Alexandria, Va. 22314

All organizations may purchase microfiche copies (65¢) or full-size copies ($3) of the documents (unless otherwise indicated) from:

Clearinghouse for Federal and Scientific Information
Department of Commerce
Springfield, Va. 22151

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GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402.

DOD and NASA Incentive Contracting Guide, October 1969. Presents a set of guidelines to incentive contracting based on present Armed Service Procurement Regulations. Order No. 0-364-685. $2.

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Defense Procurement Circular No. 73, Sept. 26, 1969. (1) Management Control Systems List. (2) Memo from the Assistant Secretary of Defense (I&L) on Third Country National Dollar Remittances. (3) Employment c Individuals on Contracts in Vietnan (4) First Article Approval. (5) Ap plication of Indirect Costs to Wor Performed at Off-site Locations. (6 Pre-Award Compliance Check. (7 Small Business Size Standards. (8 Health, Safety and Accident Preven tion Clauses. (9) Determining Defe tive Pricing (PL 87-653) of Contr (10) Revision of Standard For

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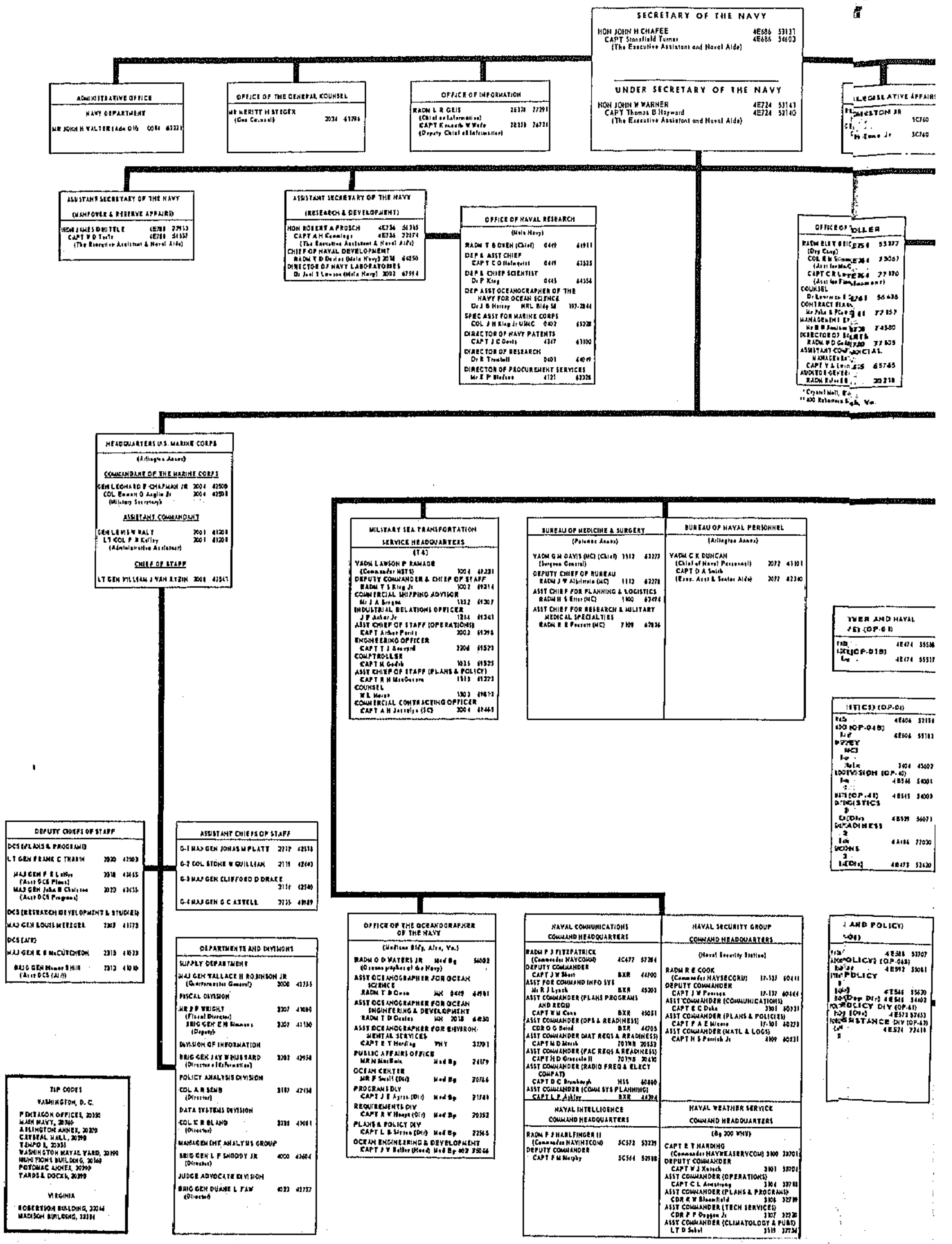
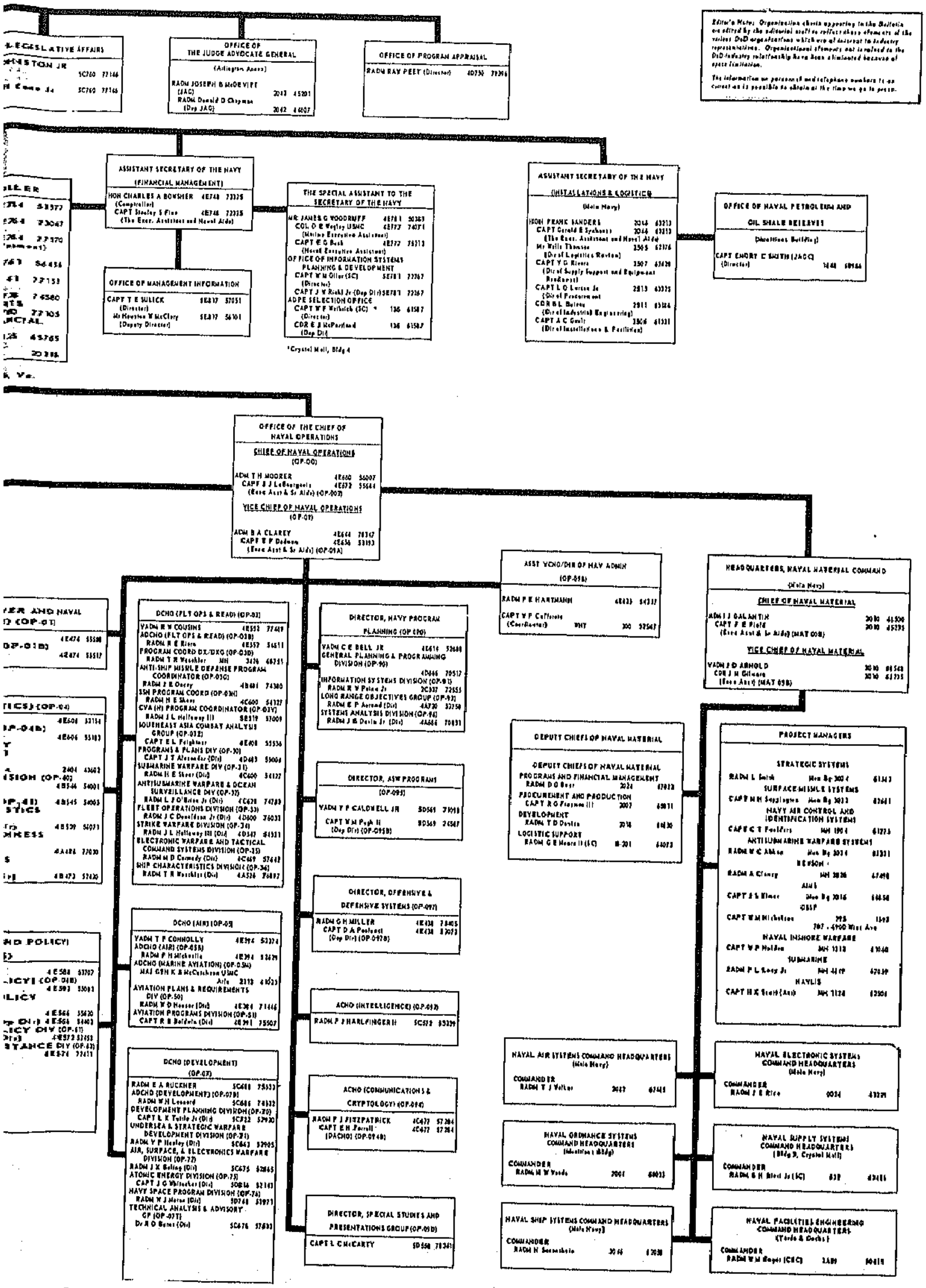
DEPARTMENT OF THE NAVY WASH

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Editor's Note: Organization charts appearing in the Bulletin are edited by the editorial staff to reflect those elements of the various DoD organizations which are of interest to industry representatives. Organizational elements not involved in the DoD-industry relationship have been eliminated because of space limitation.
The information on personnel and telephone numbers is as current as is possible to obtain at the time we go to press.
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(Yards & Docks)
COMMANDER

MEETINGS AND SYMPOSIA

JANUARY

Atomic Molecular and Solid State Physics and Quantum Biology Symposium, Jan. 19–24, at the University of Florida, Gainesville, Fla. Sponsor: Air Force Office of Scientific Research. Contact: Lt. Col. R. A. Houdibre, Air Force Office of Scientific Research (SRPS), 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) 694–5588.

FEBRUARY

Sleep Cycles and Behavior Conference, Feb. 5–7, at San Diego State College, San Diego, Calif. Sponsor: Office of Naval Research. Contact: Dr. Laverne C. Johnson, U. S. Navy Medical Neuropsychiatric Research Unit, San Diego, Calif. 92152. Phone (714) 233–2481.

MARCH

Instrumentation for Nuclear Effects Simulation Symposium, March 12–13, at Sheraton Western Skies Motor Hotel, Albuquerque, N. M. Sponsor: Air Force Special Weapons Center. Contact: Herbert M. Fernandez, Air Force Special Weapons Center (SWVI), Kirtland AFB, N.M. 87117. Phone (505) 247–1711, ext. 2035.

Prospects in Mathematics Symposium, March 16–18, at Princeton University, Princeton, N.J. Co-sponsors: Air Force Office of Aerospace Research and Princeteon University. Contact: Maj. W. R. Trott, Air Force Office of Scientific Research (SRMM), 1400 Wilson Blvd., Arlington, Va., 22209. Phone (202) 694–5264.

Fourier Spectroscopy Symposium, March 16–29, at Aspen, Colo. Sponsor: Air Force Cambridge Research Laboratories. Contact: A. T. Stair Jr., Air Force Cambridge Re-
ʼch Laboratories, L.G. Hanscom
d, Bedford, Mass. 01731, phone
') 274–6100, ext. 4911; or
ʼrge Vanasse, Air Force Cam-
ʼdge Research Laboratories, phone
7) 274–6100, ext. 3455.

Thermodynamics and Thermophysics Symposium, March 23–24, at the Lockheed Missiles and Space Co., Sunnyvale, Calif. Co-sponsors: Air Force Office of Scientific Research and Lockheed. Contact: Maj D.L. Calvert, Air Force Office of Scientific Research, 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) 694–5567.

Polytechnic Institute of Brooklyn Submilliter Waves Symposium, March 31–April 2, at the Commodore Hotel, New York, N.Y. Sponsors: Air Force Office of Scientific Research, Office of Naval Research and the Army Research Office. Contact: Lt. Col. H. W. Jackson, Air Force Office of Scientific Research (SREE), 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) 694–5565.

APRIL

Army Numerical Analysis Conference, April 2–3, at Ft. Belvoir, Va. Sponsor: U. S. Army Research Office-Durham. Contact: Lt. Col. Edgar G. Hickson Jr., U. S. Army Research Office-Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285.

International Mathematical Conference on Several Complex Variables, April 5–17, at the University of Maryland, College Park, Md. Co-sponsors: Air Force Office of Scientific Research and the Office of Naval Research. Contact: Maj. W.R. Trott, Air Force Office of Scientific Research (SRMM), 1400 Wilson Blvd., Arlington, Va. 22209. Phone: (202) 694–5264.

Twenty-fourth Annual Frequency Control Symposium, April 27–29, at Atlantic City, N.J. Sponsor: Solid State and Frequency Control Division, Electronic Components Laboratory, Army Electronics Command, Ft. Monmouth, N.J. Contact: V. J. Rublin, Chief, Solid State and Frequency Control Division Electronic Components Laboratory, Army Electronics Command, Ft. Monmouth, N.J. 07703. Phone (201) 535–2250.

MAY

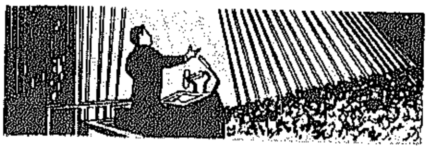
Twenty-fourth Annual Power Sources Symposium, May 19–21, at the Electronic Components Laboratory, Army Electronics Command, Ft. Monmouth, N.J. Co-Sponsors: Electronic Components Laboratory, U.S. Army Electronics Command, and the Interagency Advanced Power Group. Contact: David Linden, Deputy Chief, Power Sources Division, Electronic Components Laboratory, Army Electronics Command, Ft. Monmouth, N.J. 07703, or Arthur R. Daniel, Electronic Components Laboratory, Army Electronics Command.

NDTA Sets 1970 Meetings

The National Defense Transportation Association (NDTA) has announced its schedule for 1970 meetings. The meetings, dates and locations are:

- Fourth International Transportation Seminar, Feb. 9–11, Honolulu, Hawaii.
- Pacific Southwestern Territorial Meeting, Feb. 19–20, Las Vegas, Nev.
- Second Far Eastern International Transportation Conference, March 8–11, Tokyo, Japan.
- Southeastern Territorial Meeting, March 24–25, Memphis, Tenn.
- Eastern Territorial Meeting, April 8–9, McGuire AFB, N.J.
- Southwestern Territorial Meeting, the week of April 12, Fort Hood, Tex.
- Central Territorial Meeting, April 22–23, Colorado Springs, Colo.
- Seventh European Conference, April 29–May 1, Venice, Italy.
- Silver Anniversary Transportation and Logistics Forum, Sept. 20–23, San Francisco, Calif.

For further information, contact the National Defense Transportation Association, 1612 K Street NW, Suite 706, Washington, D.C. 20006, telephone (202) DIstrict 7–3530.



FROM THE SPEAKERS ROSTRUM

Experiences with Incentives—Changes Needed

Address by Robert D. Lyons, Dir. for Procurement Management, Office of Asst. Secretary of Defense (Installations and Logistics), at the National Contract Management Association National Symposium and Educational Conference, Washington, D.C., Oct. 13, 1969. [This address was delivered for Mr. Lyons by Jack Livingston, Procurement Analyst in the Directorate for Procurement Management.]

Before proceeding to the theme of my discussion relative to our experience in incentive contracts and our suggestion for needed changes, I would like to make two points.

First, many of the comments I will make would apply equally well to any of the other contract types.

Second, I believe that most of the changes needed are identified in the new DOD/NASA Incentive Contracting Guide.*

I would like to start by trying to clear up what I consider to be some of the most common misconceptions applying to incentive contracts; then to highlight a few of the key problem areas we have identified; and, finally, to discuss some of the major changes in the new guide.

The most common misconception is that the Government prefers certain contract types over others.

Effective pricing and sound procurement practices require discretion and judgment in selecting and negotiating the *right* contract type. While the procurement regulations state that the firm-fixed-price contract is the most preferred type for harnessing the profit motive because the contractor accepts full cost responsibility, this is not to say that the firm-fixed-price contract is always the right contract. As stated in the ASPR (Armed Services Procurement Regulation) Manual for Contract Pricing:

> **Sound procurement requires use of the right contract type. The best, most realistic and reasonable price in the world (for the particular requirement of hand) may turn sour if the contract type is wrong.**

This is especially true in the area of research and development contracting due to the nature of the work, the usual lack of definitive requirements, and the inability to measure technical objectives. The inability to measure risk frequently necessitates the negotiation of a cost-plus-award-fee or cost-plus-fixed-fee contract.

Factors contained in the ASPR Manual for Contracting Pricing, in the new DOD/NASA Incentive Contracting Guide and in the ASPR will go a long way toward correcting this misconception. Among these are:

- Emphasis placed upon the selection of the *right* contract type.
- Selection of contract type is a matter for negotiation between Government and industry.
- Contractors are encouraged to propose alternate contract types to that which is identified in the request for proposal.

In addition, there are the facts that there is now less use of cost-plus-fixed-fee contracts, and that the former use of quotas on such contracts is no longer a part of the cost reduction program.

Another general misconception is the reason for the government's increased emphasis on incentive type contracts. The reason was *not*—and I repeat *not*—originally associated with the cost reduction program and the now famous 10-percent cost savings associated with incentive contracts. I believe that I can demonstrate this effectively by giving you two dates.

First, Revision No. 8 to the ASPR, which expressed the present emphasis for incentives, was issued in March 1962.

Second, the cost reduction directive was issued in February 1963–11 months later.

ASPR Revision No. 8 was issued as a result of a serious concern on the part of DOD management with the lack of management discipline, and the attendant loss of cost, schedule and performance control in the research, development and early production of major DOD weapon systems.

All too often, large-scale weapon system development, and even produc-

Robert D. Lyons has been Director for Procurement Management, Office of the Assistant Secretary of Defense (Installations and Logistics) since 1962. Previously, he held positions in procurement and production in Air Force Logistics Command. He also has worked in industry. He holds bachelor and masters degrees in business administration from Harvard University.

**Copies of the "DOD/NASA Incentive Contracting Guide" are available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, at a cost of $2 each (Order No. 0-364-685).*

tion programs, had been undertaken before requirements were clearly defined, and before a clear determination had been made that the "technical building blocks" necessary to developing the system existed. Some examples to illustrate this point are:

• Nuclear-powered aircraft—Nearly 15 years and $1 billion were spent before the program was terminated.

• P6M jet-powered flying boat—$450 million were expended on a production contract, even though most of the technical problems had not been solved.

• SM–73 Goose missile.

• Sugar Grove, W. Va., radio telescope.

• Sky Bolt missile.

This lack of technical discipline was combined with the use of a series of contract types which provided no government contract control and no motivation to the contractors to balance costs with schedule and performance. In FY 1961, 47 percent of all contract dollars were on either cost-plus-fixed-fee or redeterminable contracts—the worst types, generally, in terms of the contractor assuming cost responsibility.

Recognizing the need for a variety of contractual forms, incentive contracts were proposed as a compromise arrangement between firm-fixed-price and cost-plus-fixed-fee, *i.e.*, the cost-plus-incentive-fee was proposed as a step above the cost-plus-fixed-fee and the fixed-price-incentive contract as a step below the firm-fixed-price contract. Most importantly, they bridged the gap between these two extremes. The Defense Department cannot purchase the wide range of products it requires having available only the firm-fixed-price contract on the one extreme and cost-plus-fixed-fee on the other.

What Is an Incentive Contract?

Probably our greatest problem in communication in the area results from a lack of agreement of what an incentive contract really is. For example:

• A Congressional committee has stated that the "firm-fixed-price contract is the incentive contract in its most pronounced form."

• The Honorable Carl Vinson once stated, "I know of no contract entered into by private enterprise that could not be considered an incentive contract."

• Former Secretary of Defense McNamara always referred to "fixed price and incentives" as though they were similar, if not the same.

Let me give you a few actual examples which will prove the extent of this problem of understanding:

• A cost-plus-incentive-fee contract with a 98/2 share ration—in other words, the Government pays 98 cents out of every dollar spent.

• A fixed-price-incentive contract with a 3/97 sharing ratio—the reverse.

• A cost-plus-incentive-fee contract with a 60/40 sharing ratio, a maximum fee of 7.1 percent and a minimum fee of 6.8 percent.

• A fixed-price-incentive contract with a 110-percent target price and a 109-percent ceiling price.

• A cost-plus-incentive-fee *term type* contract with a *ceiling*.

It is interesting to note that, notwithstanding certain negative comments we have received regarding the use of incentive contracts, every major study that has been conducted recommends their continued use. Two examples are:

• The Defense Science Board "agreed unanimously that incentive type contracting does not impede the attainment of technical objectives and that, in practice, especially in the research and development categories of engineering and operational systems development, it can be beneficially applied." The task group concluded "that priority areas for improvement are contract selection criteria and more refined appreciation of the proper circumstances of application rather than in basic changes to the system."

• The comprehensive Booz, Allen and Hamilton Report on major NASA contracts concluded that "the benefits and potential benefits of incentive contracting warrant the continued use of this technique for NASA research and development programs. . . . Incentive features aid in establishing the relative importance of specific elements of technical achievements within the overall performance objectives."

It should be noted that, to date, we have received more concrete examples of misapplication of firm-fixed-price contracts than we have on incentives.

The objective of DOD in the increased emphasis on incentive contracting, since 1962, has been an attempt to find a substitute for competition where it is limited or non-existent. This reflects the widely held belief within DOD that the cost-plus-fixed-fee contracts, commonly used up to that time for major weapon systems procurement, did not result in adequate control over costs. The goal of the incentive contract is to motivate the contractor to be efficient and *control his costs*, and the mechanism is a provision in the contract entitling the contractor *to retain a portion of any cost underrun as additional profits.*

Cost Control

It should be observed that cost control does not equate directly with an underrun of costs. In fact, one of the basic prerequisites for selection of an incentive contract is the presence of a degree of cost uncertainty which is recognized by both parties. It is for this reason that a range of probable costs is established, and the sharing provision applies to this entire range of possible outcomes.

If final actual costs consistently were identical to the originally negotiated target costs, it would strongly suggest that the wrong contract type had been selected. Such precision is not expected in this environment. If final costs were consistently below target (underrun), then there would be a basis for suspecting that the problem of overstated target costs is significant. Further, if the final incurred costs were consistently over target (overrun), then it could be reasonably concluded that the "buy-in, get well later" technique of winning the award could be suspected.

For this reason, the new guide tries to play down the use of the terms overrun and underrun by referring to them as variations from target. A cost underrun does not necessarily mean the contractor has exercised "good" cost control, nor does an overrun always result from "poor" cost control, especially if our definition of the range of incentive effectiveness as being the range of possible cost outcomes is correct. The guide, also, strongly recommends that as much attention be directed to evaluating and negotiating the upper and lower limits of the range of incentive effectiveness, as has occupied the negoti-

tion of target in the past.

Rewards and Penalties

This brings us to the second of our basic incentive contract objectives, *i.e.*, that while the contractor is to be rewarded for outstandingly effective and economical performance by high profit, he should, also, receive low profits or losses for poor performance. In this respect, at least, the incentive contract is superior to the cost-plus-fixed-fee contract which rewards the contract for oustanding performance, mediocre performance, or poor performance with the same *fixed fee.* It is significant that DOD has paid twice as many rewards for high performance under incentives as it has assessed penalties for below-par performance. The guide, therefore, introduces the concept that profit is used not only to motivate improved contractor performance or better cost control, but also to compensate the contractor in terms of profit for the value of the product to the Government.

One of the most significant new concepts expressed in the new guide goes to the area of contractor motivation. In the past, the concept has been that the contractor must achieve outstanding results in cost and performance in order to earn maximum fee. The guide now suggests that consideration should be given at times to allowing the contractor to earn maximum fee if he achieves maximum performance at target cost.

I believe in incentives, but we have learned that we must use many other existing tools in order to solve combined contractual and technical problems. None of the available techniques are mutually exclusive alternatives.

For several years, we have cautioned that contractual incentives alone cannot be relied upon to increase contractor efficiency. Other interrelated management techniques and disciplines must also be stressed.

Many years ago we learned that a good initial cost estimate, by itself, was not the only key to good incentive contracting. Often the key to good incentives is the preciseness of the statement of work or objectives. Our experiences have shown that it not only takes a good cost estimate, without over-optimism, to assure that an incentive can be effective, but that the cost estimate must be based on a good statement of work.

We need to continue the recent trend toward a pragmatic review of the application of incentives. The contract type must be appropriately applied in the context that there are many situations where a cost-plus-fixed-fee contract may be the appropriate choice, and there are many, many situations where the firm-fixed-price contract is the most appropriate. We probably oversold the drive against the indiscriminate use of cost-plus-fixed-fee contracts. Now, we are looking for optimistic realism in choice of contract type.

Our experiences have shown that we developed some incentive structures which were just too complex—they did not provide the visibility required for management or administration. We need to be innovative, but we do not need novelty or complexity. We need a contract that can accept changes, when necessary, and changes are often necessary; however, there is mounting opposition, even at the buyers' desks, to complexity, and I feel that our new computer visibility tools, introduced in the new guide, will assist us to avoid certain complexities which may make an incentive ineffective.

Our basic policies today are sound, the needed changes are found in the implementing instructions and procedures. Some of the written procedures have not kept pace with the evolving changes. We need to continually make improvements in communication of the changes to all buying levels. Primarily, the major change needed is to sell the requirement for a pragmatic look at each buying situation. We need to avoid an environment where standard operating guidelines become rigid standards for the purpose of measuring procurement efficiency.

Hopefully, the new DOD/NASA Incentive Contracting Guide will help to dispose of the misconceptions that contractors will always attempt to maximize profit; seek unreasonably high target costs; sacrifice short-term profit for extra contractual benefits; and make tradeoffs during performance which increase fee, regardless of the Government's objectives. It should also correct other misconceptions, such as those which say incentive contracts can be measured in terms of cost underruns or overruns; are designed to result in lower cost to the Government; and, if well structured, can assure program success.

U.S.-Soviet Military Balance—Its Impact on Air Force Planning and Management

Excerpt from address by General John C. Meyer, USAF, Vice Chief of Staff, U.S. Air Force, before the National Security Industrial Association, New York, N.Y., Nov. 20, 1969.

* * * * *

There is a growing recognition of the need for U.S. investment in up-to-date weapon systems as the expansion and refinement of Soviet military forces and equipment, and the chinks in our own armor, become more visible. If the trends of the last five years in U.S. and Soviet military development were to continue for long, balance in the two key elements of modern defense strategy would be transformed to our grave disadvantage. Those elements are:

Strategic nuclear forces of sufficient size, quality and flexibility to deter an attack on the United States, to discourage any other nation from either nuclear or conventional attack on our major allies, and to ensure our national interests against nuclear blackmail. This is a capability we have had for many years. I believe it to be essential so long as the freedom, independence and self-determination of nations are not adequately protected by international law. No other free world nation can provide this protective shield.

The ability to gain and maintain air superiority over any battlefield where U.S. forces may have to be committed. Without air superiority, neither air nor surface forces can operate effectively in most combat situations.

Retaining these two key capabilities sets the top priorities for Air Force planners and managers. The priorities are:

- Modernization of the bomber element of strategic offensive forces. A request for proposal on the B-1 went out to four contractors early this month. Competition will end May 18, 1970. We do not have approval to build the B-1. If we get subsequent approval for full-scale production, this aircraft can go operational probably in late 1977. The B-1 force that we hope to have will be smaller than the present bomber force, but as effective in the late 1970s as our present bomber force is today.
- If our strategic defensive forces are to carry their share of the deterrent load, we believe three things are needed: a new interceptor with greater speed, range and a look-down/shoot-down capability; AWACS for airborne warning and control; and over-the-horizon radar for improved warning. If funding for a new interceptor is not provided, we should, at the minimum, improve the F-106 with downward looking radar and a better air-to-air missile.
- Of parallel importance is the F-15 air superiority fighter. Source selection will take place next month. With an early go-ahead on full-scale production, we could have the first F-15s in operation by about 1975.

There are, of course, other systems and subsystems that are needed. One is the AX, an inexpensive attack aircraft to round out the close support team of F-4 and A-7 tactical aircraft. Another is better systems for locating and hitting small targets. In the air campaign of any future conventional war, we do not want to have to go back to a target several times with an armada of fighter-bombers, tankers, air superiority fighters and electronic countermeasures aircraft.

Continued work is essential on penetration aids for both missiles and aircraft, protective devices for ICBM sites, an advanced ballistic missile defense concept, and preliminary study and research on the next generation of weapons that ultimately will follow those that now are on the drawing boards.

Fundamental to the whole process is an active research and development program. This is another area where the Soviets are giving us a great deal of competition. Dr. John S. Foster Jr., Director of Defense Research and Engineering, has said that the Soviets' annual increase in research and development funding has been running about 10 percent, compared to a 4-percent annual growth in U.S. research and development. In our case, the increase is just about enough to offset inflation. Dr. Foster estimates that Soviet investment in research and development either has already exceeded ours, or is about to do so.

Greatest Challenge

Probably the greatest single management challenge in the process of force modernization and operation lies in weapon systems acquisition. It is necessary that we and industry meet cost estimates, performance specifications, and production schedules consistently.

In the past, there have been some very optimistic estimates of the cost of new weapon systems, both from the Air Force and from industry. The results of failure to meet an estimate can be extremely damaging. Cost estimates for a complex system to be produced several years in the future are subject to many variables, some of which neither industry nor the Air Force can control. I believe we can and must improve cost estimating, but I think it also is important that estimates be understood as *estimates*. That has not always been true and some of the fault lies with both the military and industry.

General John C. Meyer, USAF, is Vice Chief of Staff, U. S. Air Force. Prior to assuming this position, he was assigned to the organization of the Joint Chiefs of Staff, first as Deputy Director, then Vice Director of The Joint Staff, and in May 1967 became Director of Operations. From 1962 to 1966, he served as Deputy Director of Plans for the Strategic Air Command. General Meyer holds a B.A. degree from Dartmouth College, and is a graduate of the Air War College.

The Milestone Procurement Concept that will be used in the F-15 contract should help to assure more accurate estimates. This concept provides that a program will not go beyond a specified point until all accomplishments required for that contract milestone have been achieved. It ties continued development and release of production funds to a contractor's successful achievement of these well defined milestones.

The F-15 contract will have three major parts:

> **Part I covers design, redesign, and the operating cost of testing and will be negotiated on a cost-plus-incentive fee basis.**
>
> **Part II is the test aircraft and hardware to support a flight test program.**
>
> **Part III covers production of the first wing of aircraft, and training equipment.**

The latter two parts will be written on a fixed price—incentive—successive targets basis. The possibility of upward revision of contract costs, based on accumulated experience, will be taken into consideration. A ceiling will be established beyond which costs will not be reimbursed. There is a need for flexibility, in both estimating and implementation, but there also is a need for greater realism than has sometimes existed in the past.

The early identification of technical risks, by both the Air Force and contractors, is important to both estimating and accomplishment. This has been carefully scrutinized in the case of the B-1. We have been working on major components of that system for the last five years. Technical risks have not always been assessed with a cold eye, and the results can be severe in cost increases.

Holding down the number of program changes is another goal, but one over which the Air Force sometimes

has had little control. Engineering changes are something else. Here I think our record will stand a close look. The degree of operational improvement that can be achieved by an unprogrammed engineering change, once production is under way, has to be balanced against the immediate cost and also the cost of a possible future retrofit. Sometimes the change is worth the cost. Often it is not and, occasionally, we have paid a lot to gain a little. A clear definition of operational objectives will help to reduce this kind of unprogrammed change.

Reduce Paperwork

Another goal is to reduce unnecessary paper work for the Air Force and the contractor. Some progress already has been made toward this goal. The request for proposal on the F-15 required far less paper work from industry than did the C-5 request for proposal.

We also would like to reduce the number of specialized management reports required from contractors. Very often the data we need is available in a different format from the contractor's internal management data system. Some contractors have not been aware that their data may be adapted to our requirements. In other cases, our informational needs have been tied to incompatible time intervals, and separate—apparently redundant—reports have been necessary. This appears to be an area where reduction of paperwork is practical.

I know many of you are familiar with the management procedures that have been set up for the F—15. We hope that it will be a breakthrough in improving weapon system acquisition. Supervision of the program has been decentralized to Air Force Systems Command. The Program Element Monitor is located in that command rather than in the Air Staff of the Department of the Air Force. The System Program Office at Wright-Patterson AFB has immediate responsibility for managing the program. Progress review has been streamlined to eliminate marginally productive layers between the Systems Program Office and the Air Force Secretary and Chief of Staff.

There are some bugs that will have to be worked out of this new decentralized and streamlined procedure. We expect that it will fix authority and accountability clearly and visibly, improve coordination, hold the number of developmental changes to a minimum, and speed up the periodic review process and the flow of key information to decision makers. It should also improve supervision of industry performance in the developmental and production stages.

The F-15 management method will be used for several other new weapon systems, but we do not regard it as a panacea. Management methods will vary according to technical risk, cost, and size of a particular program. In some cases, where a proposed system is not too complex and expensive—the AX could be one—prototype competition may be appropriate.

I think both industry and the Air Force have done better in weapon system development and production than some recent public discussion would lead one to believe. We have to do even better in the future. The increased threat, linked with tight budgets, demands it. Congress demands it. The public demands it.

The Air Force cannot meet its objective of economical and efficient modernization without the support of industry and, of course, the public. Unless we demonstrate unquestioned ability to plan and manage efficiently and clearly in the national interest, public support will be less than wholehearted. This is a challenge for both military and civilian planners and managers.

Navy Contracting Process for Aircraft Maintenance

Excerpt from address by Captain J. E. Harvey Jr., USN, Assistant Commander for Contracts, Naval Air Systems Command, at First Annual Navy Contract AeroSpace Services Symposium, National AeroSpace Services Association, Washington, D.C., Oct. 29, 1969.

[Editor's note: Film clips and slides were used in the delivery of this address. Information presented by visual aids has been included in the text.]

Captain J. E. Harvey Jr, USN, is Assistant Commander for Contracts in the Naval Air Systems Command. In previous assignments, he has served as Navy member on the Armed Services Procurement Regulation (ASPR) Committee; member of the planning group for the establishment of the Defense Supply Agency; and Deputy Commander for Purchasing in the Naval Supply Systems Command. Capt. Harvey holds a B.E. degree from Tulane University, an M.B.A. degree from Harvard University, and a J.D. degree from George Washington University.

It is a distinct pleasure to meet with you in this the first Navy Contract AeroSpace Services Symposium. I trust this symposium will result in an improved understanding of our respective roles. It is to be hoped it will, also, result in an expanded industrial base upon which the Navy can rely for timely technical support of its needs. . . .

I think it is important to remember that the end objectives of contracting are to obtain required supplies or services on time and at a fair price in order to effect a military objective. We should not become so enamored of the contract terms and provisions that we forget the military objective. I also wish to emphasize that we are willing to pay a fair profit. . . .

The Naval Air Systems Command (NAVAIR) has responsibility for the

development, production and support, which includes commercial contracting, for all air weapons for the Navy and the Marine Corps and, in some cases, for other Military Services and government agencies. . . . Aircraft maintenance and services are included. . . .

The contracts function commences with advanced planning for initial acquisition and extends through the production and support phases. In achieving the Navy objective of complete integrated logistic support for the total weapon system, our contracts necessarily reflect requirements for all logistics support elements such as supply provisioning, technical data, ground support equipment, operator and maintenance trainers, and training of fleet personnel.

* * * * *

There were 12 commercial aircraft maintenance contracts awarded in FY 1969 amounting to $18.8 million, covering work on 420 aircraft. In FY 1970, 11 contracts have been awarded amounting to $26.7 million, covering 407 aircraft. Representative aircraft included in both fiscal year programs are the C-118 transport, C-47/117 transport, T-34 trainer, and the P-2 patrol plane. An interesting addition to the FY 1970 program is the initial commercial contract for S-2 trackers. The dollar value for FY 1970 represents fixed prices for known work to be accomplished. This amount may be increased by as much as 30 percent to cover "over and above" effort included in the existing contract scope. I will speak later on the "over and above" work category.

* * * * *

Work Scope and Pricing Arrangement

First of all and most importantly, we attempt to obtain competition for aircraft rework programs, wherever feasible and practicable. I think this is borne out by the fact that 10 out of 12 of our aircraft commercial rework programs are contracted for on a negotiated competitive basis. We maintain a Source List. Every firm on the list is solicited for each competitive procurement. . . . Several of our procurements have resulted in set-asides for small business and labor surplus areas.

In general, our aircraft rework contracts are structured on the basis of the line items shown in Figure 1.

Structure of Aircraft Rework Contracts

Section A—Supplies or Services and Prices

Item	Supplies or Services
1	Services/Materials To Perform Model—Series Aircraft Progress Maintenance.
2	Services/Materials To Perform with Item 1, the Following Fixed-Price Work under this Contract: a. Accessory/Component Overhaul. b. Engine Changes. c. Post-Acceptance Aircraft Flight. d. Stripping/Resealing Fuel Tanks.
3	Services/Materials To Perform with Item 1, the Following Negotiable Work under this Contract: a. Aircraft Service Changes, Special Modifications and other Technical Directions. b. Correction of Extensive Corrosion. c. Repair of Major Damage. d. Emergency Repairs/Modifications of Aircraft on a "Drop In" Basis and On-site Crash Damage Repair. e. Packing, Preserving and Preparing Government-Furnished Materiel (GFM) for Shipment. f. Stripping/Painting Interior Surfacs. g. Normal Post-Acceptance Maintenance. h. Installation/Removal of Special/Unusual Equipment. i. Fabricate Parts from Bulk GFM, Repair GFM, and Make GFM Ready for Installation. j. Out-of-Frequency Work.

Figure 1.

Item 1 is work for which the scope, depth and frequency can be defined and which is required to be performed on each aircraft inducted for rework. This would include receipt of aircraft, disassembly, inspection procedures, certain repair and overhaul, reassembly, flight testing, etc. A firm fixed unit price is established in the contract for this work.

Item 2 is work for which the scope and depth can be defined but the frequency, *i.e.*, the number of times the work would need to be accomplished, cannot be predetermined. Examples of this work include engine changes, component overhaul, post-acceptance flights, stripping and resealing of fuel tanks, etc. A firm fixed unit price is also established for this work but the contractor cannot proceed until the work is ordered by the administrative contracting officer (ACO). The contractor is responsible for requesting the ACO to place an order as soon as the need for the work becomes known. This is commonly referred to as fixed price "exclusion" or "over and above" work category, which I mentioned earlier.

Item 3 is work for which neither the scope, depth, nor frequency can accurately be defined in advance. Examples include correction of corrosion, repair of major damage, accomplishment of aircraft service changes or other technical directives not required by the rework specification, packaging of material to be returned to the Government, etc. A firm-fixed-composite-labor rate which includes direct and indirect labor, overhead and profit is established for this work prior to contract award. The actual price paid for the work is determined on the basis of negotiated labor hours at the composite rate plus material at cost. Negotiations are conducted by the ACO with the contractor. This work must be ordered by the ACO. Again, the contractor must request authority from the ACO to accomplish the work

as soon as the need becomes known. This is also referred to as negotiable "exclusion" or "over and above" work.

In addition to the pricing structure and the terms and conditions of the contract, our solicitations contain a section entitled, "Additional Solicitation, Instructions and Conditions." While this section is generally at the end of the document, it should not be overlooked since it contains very important and pertinent information. Notices of pre-proposal conferences, location of technical data, price evaluation factors, contractor responsibility standards, etc., are all included in this section.

Price Evaluation and Contractor Responsibility

Regarding price evaluation, we first consider the total price for the Item 1 firm-fixed price work, *i.e.*, the unit price for Item 1 work multiplied by the total quantity of aircraft scheduled for rework during the period of the basic contract. Second, for fixed price "exclusion" or "over and above" work, we multiply the fixed unit price by quantity factors established for evaluation purposes only. For example, if the quantity of aircraft scheduled for rework is 40 single-engine aircraft, the number of engine changes may be multiplied by a factor of 50 percent on the presumption that half of the engines will require changing. Third, for the negotiable "exclusion" or "over and above" work, we multiply the composite labor rate by the total number of hours estimated to accomplish "exclusion" or "over and above" work on all aircraft scheduled for rework during the basic contract period. Bear in mind that these factors are only best estimates for evaluation purposes, and are not to be construed as actual work effort which would be required under a contract.

Finally, the total evaluated price is based on the Items 1 and 2 fixed prices and the Item 3 labor rates, multiplied by the pre-established evaluation factors set forth in the request for proposal. This total evaluated price is the basis on which prospective contractors are considered for award starting with the lowest acceptable proposal. We may negotiate with all those firms within a competitive range, price and other factors considered. However, each proposal should be submitted on the most favorable terms which the contractor can submit to the Government, since the Government may award a contract based on initial offers received without discussion or negotiations of such offers.

Regarding contractor responsibility standards, we generally conduct pre-award surveys to determine a prospective contractor's capability to perform in accordance with the requirements of the proposed contract. However, if information is readily available regarding a prospective contractor's capability to perform, award may be made without an on-site survey. We also use available historical cost, rates and other information to assist our reviews. Upon award of a contract, all unsuccessful offerors are notified of the number of contractors solicited, number of proposals received, name and address of the successful contractor, and award price.

Improved Methods Benefit Contractor, Government

We believe that our present contracts represent a significant improvement in contract methods for aircraft rework over those of prior years.

For example, approximately two or three years ago our Item 1 price included all component overhaul. There was no "exclusion" or "over and above" item for component overhaul. While the scope and depth of component overhaul could be defined, the frequency, *i.e.*, the number of times a component would require overhaul during the life of a contract, could not readily be determined. Some aircraft have up to 300 components and this presented an undesirable situation. From the contractor's point of view, a low estimate on the frequency of component overhaul could result in the contractor being put into a loss or low-profit position if actual component overhaul far exceed his original estimate on which he based his Item 1 price. On the other hand, if all contractors estimated too high for the frequency of component overhaul, the Government could be placed in a position of paying for work which would never be accomplished.

In order to eliminate this situation, we now price component overhaul as a fixed price "exclusion" or "over and above" item in the contract. Each time a component is required to be overhauled, the ACO will issue an order to the contractor at the fixed price stated in the contract. While additional administrative effort is required for this procedure, we feel it represents the most fair and reasonable approach to contracting for component overhaul, and also puts the evaluation of prospective contractors' proposals on a more equitable basis.

Significant improvements have also been made in the aircraft input schedules and "turn-around" times. In the past, the first month's input often was nearly as high as, or equal to, any other month's input and the turn-around time did not provide for a learning process. Our recent contracts and solicitations, where fleet requirements permit, provide for an input schedule of only one or two aircraft the first month and allowance is made for greater turn-around time for the first several aircraft inducted. This improvement went into effect in the current fiscal year.

Government-furnished material (GFM) is another area in which we feel we have made improvements. Under a recently adopted Single Supply Support Control Point (SSSCP) System, all material, with the exception of bulk-type materials such as greases and lubricants, are provided by the Government to the contractor for the performance of the contract. The SSSCP receives and processes all contract requirements for material, and serves as the single contact point on all supply matters for the contract. Also, the Naval Air Rework Facility at the designated SSSCP provides engineering and logistical services for support of the aircraft undergoing rework. Recognizing that GFM is often a problem, particularly when older out-of-production aircraft are involved, we feel the SSSCP System is a step in the right direction to provide GFM in a timely and economical manner.

As mentioned before, we maintain a Source List used in solicitation for each competitive procurement. I encourage those firms not on our list to make application and receive solicitations for our future aircraft rework requirements. To obtain information on appropriate procedure, you may contact: Naval Air Systems Command, Code 20122, Room 1641, Munitions Building, Washington, D.C. 20360.

Small Business Contribution to Security and Economy of the Nation

Excerpt from address by Lt. Gen. Harry E. Goldworthy, USAF, Dep. Chief of Staff, Systems and Logistics, Hq., U.S. Air Force, at the Business Opportunity/Federal Procurement Conference, Albuquerque, N. M., Nov. 13, 1969.

* * * * *

Small business has continuously flourished as a pillar of the American way of life. It has done so because, as a people, we have always believed—and still believe—that competition must prevail in the market place. Indeed, few Americans today would question the importance of small business in our way of life or the wisdom of helping to maintain and strengthen its influence in the economy.

Although it can be seen that throughout the history of our country the small businessman has played a major role, there are times when he is hard pressed. He neither has the resources of the larger corporation, nor does he have the market research and management controls that larger business generally has. On the other hand, his decision-making process is less cumbersome. A good, small firm can provide flexible and responsive engineering, low administrative costs, and first-rate products.

We have heard it said that every small business wishes to become big business. This, of course, is not always true and neither will nor should it happen across the board. A better statement might be that, with rare exceptions, every big business was once small.

The question often arises as to how our Government should treat small business in carrying out the policy of the Congress as expressed in the Small Business Act. The act reads, in part:

> "It is the declared policy of the Congress that the government should aid, counsel, assist and protect, insofar as is possible, the interest of small business concerns in order to preserve free competitive enterprise, to insure that a fair proportion of the total purchases and contracts or subcontracts . . . be placed with small business enterprises." (15 USC 631, Sec 2a).

The Federal Government follows policies that foster growth during the early—and sometimes critical—years in the life of a new business.

Small companies should know that there will be reasonable safeguards to protect them from unfair competition, and that they can prosper if they are creative and efficient.

In the event that a reduction of requirements makes necessary the termination—in whole or in part—of a contract, there must be a prompt and fair settlement with the contractor. This is equally true whether the contractor is doing business directly with the Government or performing as a subcontractor at any level.

This might be a good point at which to comment on observations I—in fact, probably all of us—have heard about doing business with small business.

We have all heard the remark, "It costs more to do business with small business concerns." This just is not so. Of course, there might be isolated instances one could cite, but they would be the exception.

While talking on this subject, let us get rid of another of the old wives' tales. This one is that small business gets favored treatment. Again, it is not so. If the words were changed to read "fair treatment," then I would say that is what we seek to do.

In general, it seems that small business problems fall into three areas of major need and concern:

- Obtaining a fair share of government procurement.
- Gaining access to adequate capital and credit.
- Obtaining competent management, technical and production counsel.

Let me hasten to say that large business shares some of these same problems.

Lieutenant General Harry E. Goldsworthy, USAF, is Deputy Chief of Staff (Systems and Logistics), Hq. U.S. Air Force. In his previous assignment he was Commander, Aeronautical Systems Division, Air Force Systems Command. He holds a bachelor of science in business administration from Washington State College. He is a graduate of the Army War College and the Industrial College of the Armed Forces.

Incidentally, if notice has been taken that I have not discussed large business, the omission has been intentional. It is not that large business does not play an important role as a supplier of government's requirements, for it, too, makes tremendous contributions to our defense posture. The fact is that most people here today are small businessmen.

"8a Contracts"

Consider for a moment an area of national concern—it has been called the problem of employment. There is no question but that socio-economic problems exist in this nation. The Government has launched programs to mobilize the resources of private industry and the Federal Government to help find jobs and to provide

training for thousands of America's hard core unemployed. The Defense Department is making positive contributions to the social needs of the country which, in turn, contribute to our national strength.

One area where we are helping is by awarding contracts to the Small Business Administration (SBA) under the provisions of Section 8(a) of the Small Business Act. The SBA, in turn, places these requirements on a preferential basis with companies that agree to hire and train the disadvantaged.

In making these awards, our purpose is to establish self-sustaining, competitive small businesses. A potential recipient of such an award, commonly called "8a contracts," will be required in the future to have a business plan approved by SBA. This plan will permit DOD to determine the extent of its commitments and the degree to which DOD contracts will assist in bringing the company to a competitive status and, thus, eliminate further use of "8a" contractual support at a discernible time.

I do not wish to appear redundant, but let me try to capsule some thoughts and observations. The Congress has made it abundantly clear that our resources must be used in every way possible to increase the contribution of small business to the general welfare. In economic terms, this is a command to help strengthen the competitive structure by helping small business offer America the highest quality and the greatest variety of goods and services at the lowest fair and reasonable price. In social terms, this is a mandate to preserve and strengthen the small business community as an outlet for imagination, initiative and individualism in America.

The concern to keep economic power distributed among many independent proprietors is one that goes back to the nation's beginning. It was a favorite theme of Benjamin Franklin and Thomas Jefferson who feared that industrialization might lead to a propertyless labor class.

Today, there is a continuing need to evaluate the place of small business in our economy, as well as the actions necessary to create and maintain an economic climate in which small business may be virile and significant.

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Industrial Security Award Winners

The Defense Supply Agency presented James S. Cogswell awards to 28 companies for superior performance in carrying out security obligations on classified defense contracts in 1969.

Approximately 13,500 industrial firms having DOD security clearances were considered for the awards. Factors in selecting the winners included:

- Degree of security consciousness evidenced by management personnel of industrial organizations.
- Security education and motivation program by contractors for employees.
- Regular inspections by contractors of security practices within the organization.
- Security review procedures in company publications and advertising.
- Adaptation of new security methods in such areas as reproduction and transmission of documents, control of movement of employees and visitors within plants.

Two types of awards are presented: plaques for outstanding performance and certificates for excellence. Fourteen plaques and 24 certificates were awarded.

Plaques for outstanding performance were awarded to: **Honeywell, Inc.**, Minneapolis, Minn.; **General Dynamics, Pomona Division**, Pomona, Calif.; **Lockheed Electronics, Division of Lockheed Aircraft Corp.**, Watchung, N. J.; **Illinois Institute of Technology Research Institute**, Chicago, Ill.; **Western Union Telegraph Co.**, New York, N. Y.; **Varian Associates**, Palo Alto, Calif.; **Stanford Research Institute**, Menlo Park, Calif.; **HRB Singer, Inc.**, State College, Pa.; **Honeywell Inc., Marine Systems Center**, Seattle, Wash.; **TRW Systems Group**, San Bernardino, Calif.; **Curtiss-Wright Corp., Electronics Division**, E. Paterson, N. J.; **Darsel Graphic Arts Services, Inc.**, Washington, D. C.; **KMS Industries**, Sherman Oaks, Calif.; and **Shock Hydrodynamics, Inc.**, Sherman Oaks, Calif.

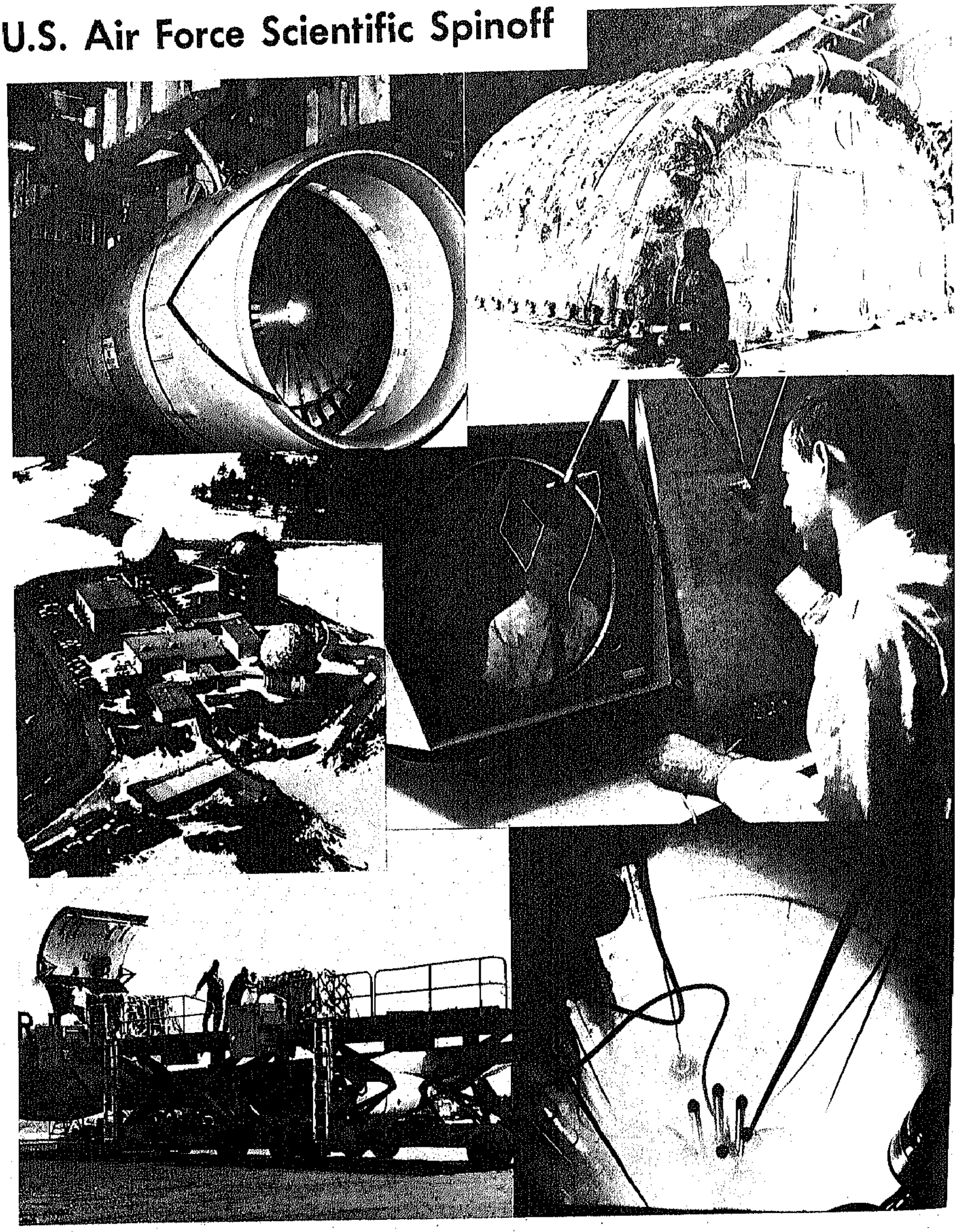
Companies selected to receive certificates of excellence were: **Bell Telephone Laboratories, Inc.**, Murray Hill, N. J.; **Day and Zimmerman, Inc., Lone Star Division**, Lone Star Army Ammunition Plant, Texarkana, Tex.; **Chamberlain Manufacturing Corp.**, Waterloo, Iowa; **Bendix Corp., Navigation and Control Division**, Teterboro, N. J.; **Martin Marietta Corp., Denver Division**, Denver, Colo.; **Radio Corporation of America, Astro Electronics Division**, Princeton, N. J.; **Federal Electric Corp.**, Paramus, N. J.; **Itek Corp.**, Lexington, Mass.; **ARO, Inc.**, Arnold AFS, Tullahoma, Tenn.; **Singer-General Precision, Inc., Kearfott Group GPL Division**, Pleasantville, N. Y.; **EG&G, Inc., Santa Barbara Division**, Goleta, Calif.; **ITT Electro-Physics Laboratories, Inc.**, Hyattsville, Md.; **North American Rockwell Corporation, West Virginia Plant**, Princeton, W. Va.; **Avco-Everett Research Laboratories**, Everett, Mass.; **The Boeing Co., Air Force Plant 77**, Hill AFB, Utah; **Midwest Research Institute**, Kansas City, Mo.; **KMS Industries, Inc., Litho Crafters Division**, Ann Arbor, Mich.; **Raytheon Co., Communications and Data Processing Operation**, Norwood, Mass.; **Union Carbide Corp., Materials Systems Division, Speedway Laboratories**, Indianapolis, Ind.; **Industrial Nucleonics Corp.**, Columbus, Ohio; **Photocopy Co., Inc.**, Santa Clara, Calif.; **Hayes International Corp.**, Albuquerque, N. M.; **Federal Electric Corp.**, Streator, Ill.; and **Western Union Telegraph Co.**, Belleville, Ill.

The annual award is named in honor of the late Colonel James S. Cogswell, USAF, first chief of a centralized office of industrial security, established in January 1965 under the Deputy Director for Contract Administration Services of the Defense Supply Agency.

Navy Announces More Ship Retirements

The Navy has announced the names of an additional eight destroyers and two aviation units to be retired as part of the Defense Department's economy program begun last August. The new retirements bring the total ship decommissionings to 111 and total aviation unit retirements to 13 during FY 1970.

U.S. Air Force Scientific Spinoff



[Editor's Note: The following is a reprint of a pamphlet developed by the Air Force Office of Information.]

Through the ages man has depended upon his inventive talents. He progressively developed the stone wheel into the rubber tire, and the maze of controls and instruments required for man's first moon landing vehicle. Byproducts also have played an important part in man's progress.

From crude oil came the kerosene for lamps during the Victorian era. It was later refined into gasoline to power the horseless carriage. Leftover tars were developed into medicines, plastics, and synthetic wash-and-wear fabrics.

Even the search for new systems for defending our country, or for investigating the mysteries of space, produced scientific advances for mankind. In the Air Force, major research and development is directed toward scientific advances required for military applications.

Aircraft have developed in the same manner. Starting with the X-1, X-2 and X-3, the Air Force applied the knowledge gained from these projects to the fighters and interceptors developed for our operational forces. Then came the X-15, XB-70, YF-12A and SR-71, incorporating the knowledge gained from each. Today, scientists are poring over the tons of data from the Air Force's experimental aircraft to find answers for the supersonic transport (SST).

It would be difficult to estimate the vast sum of money saved through this stepping stone procedure. It would be even more difficult to evaluate or pinpoint all of the benefits and specific items used in industry, commercial aviation, medicine, or in the home, that began in an Air Force laboratory or in the development of an Air Force system. However, all of these benefits represent scientific progress contributed by the Air Force to the nation's economy, safety, health, and standard of living.

Top left: TF-39 jet turbo-fan engine for C-5 cargo aircraft mounted on test pad. Turbo-fan engines have increased the economy of operation of civilian aircraft.

Top right: Air inflatable shelter undergoing arctic climatic testing at Eglin AFB, Fla. Air inflated structures have many civilian applications.

Center left: Radar site at Sundance, Wyo. Geodesic radomes protect antennas from wind and snow. A geodesic roof now shields sports fans.

Center right: Communications research led to a laryngeal cancer detection method now being developed by the U.S. Public Health Service. Dr. Philip Lieberman, Air Force Cambridge Research Laboratories, uses a small computer to make an area analysis of vocal cord opening.

Bottom left: Cargo is rapidly unloaded using the 463-L Materiel Handling System. Civilian airlines have adopted similar automated cargo handling methods.

Bottom right: Control rods, which regulate the rate of nuclear fission, protrude from the reactor and shielding water at Sundance, Wyo., nuclear powered radar site. Nuclear power is rapidly becoming a civilian source of electricity.

Commercial Aviation

Commercial and military aviation have always had a wingtip-to-wingtip relationship. In the early days, many commercial aircraft were converted to bombers or military transports. The DC-3, known as the C-47 in the Air Force, is an outstanding early example. Even today, commercial aircraft have been purchased by the Air Force for current use and to save research and development costs. Examples include the T-39 Sabreliner and the O-2A Super Skymaster.

The jet airliner became a reality on the basis of development and production of the B-47 and B-52 strategic bombers and the KC-135 Stratotanker aircraft. The XB-70 was never used operationally by the Air Force, but it was flown many hundreds of hours as a flying laboratory for the Air Force, the National Aeronautics and Space Administration (NASA), and the supersonic transport program.

Jet airliners became economical and practical only after the development of Air Force jet engines, jet fuels, and lubricants which resulted in increased engine life. Fuel consumption rates were also reduced, so the costs became competitive with propeller-driven aircraft. Another Air Force advancement that found its way into the commercial airline inventory was the turbo-fan engine that was developed for the B-52H bomber and the C-141 jet transport. In addition, Air Force fuel and lubricant programs provided the industry with techniques and manufacturing standards to produce these items in quantity, with the proper quality control to meet the demands of the commercial airlines.

A descendant of one of the Air Force's most sophisticated aircraft inertial guidance systems will be used on the new Boeing 747 jetliner. This provides greater flight accuracy at the high altitudes and speeds at which the world's largest jet airliner operates. Also, large jetliners would require longer landing distances if it were not for the turbine engine thrust reverser and beryllium brake linings developed by the Air Force.

The IFF (Identification—Friend or Foe) electronic equipment, developed for the Air Force to identify aircraft from the ground in combat situations, is being used by air traffic control installations to quickly spot specific aircraft in commercial airlanes. Another Air Force device, used by air traffic control monitors, is a high-power klystron radio frequency (RF) generator which improves air traffic separation.

Commercial aircraft builders are making increasing use of titanium, one of the strongest lightweight materials available for super jetliners. The Air Force was instrumental in developing materials and manufacturing techniques required for aircraft construction.

The airlines are following the Air Force in improving freight-handling efficiency through the automated techniques developed for the 463L Material Handling System. These techniques include both the computer control procedures and the standard pallet and motorized moving equipment used by the Air Force.

In addition, thousands of special seals, valves, fuel components, electronic hardware, and other aircraft parts have been developed by Air Force programs, and are now standard items for commercial aircraft manufacturers.

Agricultural, Industrial and Manufacturing

Effects of Air Force research and development projects have left their impact on virtually every phase of the country's productive economy.

One of these projects, the klystron-powered linear accelerator, is a device for imparting large kinetic energy to charged particles, such as electrons or protons. In the plastics industry, this accelerator is used for the cross-polymerization of plastics to produce better products for home and industrial use. The food industry employs this equipment for large-scale food sterilization and food preservation processes, and metal casting producers use it to detect imperfections in production.

High-resolution radar, developed and improved by the Air Force for bombing, navigation, and intelligence missions, is now being used for oil deposit search missions. Agricultural interests are depending on the same equipment to conduct crop and soil surveys. In geology, the high-resolution radar was used to determine various earthquake faults for scientific studies and possible earthquake prediction forecasts.

To provide a special reinforced plastic rocket case, Air Force engineers depended on a filament-winding process resembling the criss-cross pattern found on a spool of darning yarn. Industrial liquid processors have been constructing storage tanks and railway tank cars using this technique to produce lightweight and noncorrosive containers.

Like most scientists, Air Force research and development engineers have experimented widely with peaceful applications for nuclear energy. The Air Force's nuclear power plant at Sundance, Wyo., established many records for endurance and minimum nuclear fuel requirements. Many electrical producers throughout the country are converting to nuclear power as an electrical source which is more efficient and causes no further disfigurement of our natural resources.

Another benefit for many may result from a new, quick-hardening cement developed by the Air Force to repair rocket- or shell-damaged runways in Southeast Asia. A commercial firm is experimenting with this material in Dallas, Tex., as a speedy technique to repair potholes and other road and highway defects.

Infrared sensors that are used by the Air Force for air intelligence surveys and scientific studies have been adapted by the steel industry to control the thickness of rolled steel.

Commercial Applications

Many of the products or ideas that began in Air Force research and development laboratories are most apparent when they appear on the commercial scene.

The air-inflatable radome principle, used to protect radar equipment from the elements, has had many civilian applications. Giant balloon-like tents, which retain their shape under low air pressure even when punctured, are used for swimming pool covers, tents, temporary housing structures, and as forms for sprayed concrete buildings.

The rigid geodesic radome, a more permanent structure based on an unusual geometric pattern of plastic or fibreglass panels, has been used in various buildings throughout the world. One of the most familiar examples is the gigantic Astrodome in Houston, Tex.

Electronic detection sensors used by the Air Force to protect strategic bomber and missile bases from unauthorized visitors have been adapted for industrial and commercial burglar alarms. There are no wires or other power sources that can be cut off, and the detection devices cannot be seen by an intruder.

Another similar device is the magnetic detector. Its commercial applications include determining if an individual is carrying firearms, and preventing pilfering.

The infrared sensors used by the Air Force for night aerial photography and other scientific work have been converted by mine safety personnel to detect coal mine fires. They also are used for leak detection in gas lines.

The Air Force also has an airborne infrared terrain reconnaissance sensor which has been adapted for fire spotting by the U.S. Forestry Service.

A major Air Force contribution has been in the development of integrated circuits. These electronic devices, each doing the work of as many as 70 conventional components, have made possible the sophisticated third-generation computers being used or developed today, besides improved radio, television, hearing aids, and other electronic equipment.

The electronic computer, now deeply imbedded in almost every aspect of civilian life, owes much of its development to pioneering use by the Air Force in air defense systems. Transmission of digital data to computers over commercial communication lines was proven possible in these systems. The Air Force continues at the forefront of computer technology as the largest user of electronic data processing equipment in the world.

Medical Aids

The cumulative effect of various Air Force research and development programs includes contributions to medical science. Unlike the majority of military equipment, medical techniques and tools are used for the same purpose in civilian hospitals as in military medical facilities.

Air Force aeromedical research centers developed electron beam microprobe analysis, which is being used for advanced biological tissue examination and diagnosis.

The laser, which is finding more scientific applications each day, is being used by doctors for distended eye retina surgery.

Sensor devices used to monitor pilot heartbeat, respiration, and other body functions during the X–1, X–2 and X–15 flights, and during early space environment experiments, have also been applied in the civilian medical world. These biosensors allow a nurse or doctor to monitor several patients at a central station, providing a constant observation and warning system. Another advanced version of this technique allows a doctor, working in his office, to check a patient at his home, by means of a special sensor connected to the invalid's telephone circuit.

Many electrical and mechanical components required for artificial heart and kidney machines were made possible by Air Force equipment development projects. These projects included miniaturization of many parts to reduce the machines to practical sizes.

Communications and Electronics

Troposcatter communications, which increases the range of a radio signal by bouncing it off the troposphere, was developed by the Air Force in 1955. This technique has been adopted commercially and is being used as a communications link in the Persian Gulf, and by several oil companies for voice links over vast distances.

Portable color television cameras were made possible by integrated circuits, miniature components, and module construction techniques. Other contributing factors include the lightweight metals developed for aircraft, missiles, and various space projects.

The solar cell that turns sunlight into electrical energy is another innovation with commercial application. The emergency telephone system along the Los Angeles Freeway uses solar cells as a power source.

Consumer Products

Air Force development dividends also are reflected on a broader scale by products that would be recognized by the average consumer. A typical retail item is an electric wristwatch powered by a tiny nickel-cadmium battery developed for Air Force use.

A razor blade that advertises its special cutting edge owes its success to a thin film sputtering technique developed as a metal processing refinement by the Air Force.

Many advances used in producing long-lasting emergency flares for hunters and private pilots are based on Air Force-developed technology.

In other safety areas, the Air Force has long advocated seat belts for automobiles and has worked with several universities and foundations in developing automobile safety standards. Much of this work has been conducted on rocket sled tracks to determine the effects of high-speed crashes on dummies and automobiles.

Another Air Force-related item adopted by the automotive world is the radio antenna installed in the windshield, a technique used for years in cockpit canopies.

Materials developed for specific Air Force applications have found their way to the retail buyer in various other forms. The highly heat-resistant, compressed carbon lining developed for rocket propulsion fuel cases can now be purchased in most stores as a man's smoking pipe that is supposedly cooler smoking and longer lasting than natural briar.

For vacation use, products born in Air Force laboratories include silicone-impregnated plastics, light in weight and almost as strong as steel, which provide containers for clothes and overnight bags. They also are suitable for the colorful, unsinkable boats used for fishing or pleasure. Vacation items also include the transistor radio and sunglasses that become more opaque as the sun becomes brighter. These glasses were originally developed for aircraft pilots and crews exposed to sudden nuclear flashes.

Even at home the Air Force has had an influence on daily living. Super alloy yarns, developed for high-speed parachutes and space clothing, are now used in modern carpeting, drapes, and moothproof, stain-proof, fire-resistant clothing.

Solid-state, plug-in modular television components, now available commercially, are based on electronic construction concepts and techniques developed by the Air Force years ago.

During World War II, frozen dinners which could be heated rapidly were developed for B-29 Superfortress bomber crews. Further developed for aeromedical requirements, they were later modified by commercial food firms to become the "TV" dinner—a household item for the American family.

A modern cookware made from a white ceramic that does not burn, change color, or crack under sudden temperature changes uses the same material developed for the ablative, heat-resistant nose cone of an Air Force intercontinental ballistic missile. An Air Force material laboratory developed a cloth-like paper that is used as the filter for one of the new coffee makers found in many American kitchens.

Although military research and development projects are normally undertaken for national security purposes, many times man's individual safety, comfort and convenience are also served. In this way, both the American people and the Air Force are rewarded.

CDC Establishes STANO Division

The Army Combat Developments Command (CDC) has established a new division at its Fort Belvoir, Va., headquarters to oversee programs related to surveillance, target acquisition and night operations (STANO).

Overall goal of the STANO program is to improve the Army's capability to find the enemy, and to operate at night. STANO is part of a total battle field information gathering system intended to provide the capability to find the enemy, and to provide adequate intelligence on which to base command decisions.

The objective of the STANO Division is to plan and monitor the introduction of STANO capabilities into the field Army. The major CDC activity conducting this effort is the STANO Studies Directorate, formerly organized as Task Force RIPOSTE.

The new division will serve as a point of contact for both intercommand coordination and Army staff command coordination. Lieutenant Colonel Leslie D. Carter Jr. has been named chief of the STANO Division.

C-5 Program Reduced, Air Force To Buy 81

The Air Force has announced that funding for the C-5 procurement program for FY 1970 will not go beyond 23 aircraft. The decision provides for a total program of 81 aircraft.

In a July 1969 report, the Air Force anticipated additional increases in the program to bring total costs for 120 aircraft to $5.1 billion. A subsequent detailed review of costs indicated that an additional $149 million would be required to complete the 120 aircraft program. The additional costs were attributed to inflation and production difficulties.

Budget restraints required the Air Force to re-examine the FY 1971 budget program requirements, resulting in the reduction from 120 to 81 aircraft of the program. Further analysis of the cost impact of the reduction is being conducted by the Air Force to determine possible overall changes in the current $5.1 billion program cost.

DEFENSE INDUSTRIAL PLANT EQUIPMENT CENTER

MEMPHIS, TENNESSEE 38102

Phone (901) 743-341

Editor's Note: This chart replaces the chart which appeared in the November 1969 Defense Industry Bulletin, page 25. Since publication of the earlier chart, there have been organizational and personnel changes at the Center. Organization charts appearing in the bulletin are edited to reflect those elements which are of interest to industry representatives. Organizational elements not involved in the DoD-industry relationship are omitted because of space limitation.

Names and telephone numbers are as current as possible at press time.

COMMANDER
CAPTAIN HUGH D BYRD, SC, USN 501

EXECUTIVE DIRECTOR
HUGH R CARRINGTON 502

OFFICE OF PLANNING AND MANAGEMENT
F A MORRIM, JR, DIRECTOR 505

PLANS, PROGRAMS AND ANALYSIS DIVISION
P H Coons 535

SYSTEMS, PROGRAMMING AND PROCEDURES DIVISION
W C Wilson 533

PROCUREMENT DIVISION
E T Burns 516

MANAGEMENT CONTROL DIVISION
T H Tuttle 576

MISSION EXPANSION PLANNING OFFICE
W C Wilson 533

OFFICE OF COMPTROLLER
W R MILLER, COMPTROLLER 523

FINANCIAL MANAGEMENT DIVISION
M L Sikes 524

PERFORMANCE ANALYSIS AND REPORTS DIVISION
J T Lawrence 660

DIRECTORATE OF STORAGE AND MAINTENANCE
COL C M ANDERSON, USAF, DIRECTOR 623
C L MOORE, DEPUTY 624

STORAGE AND MAINTENANCE OPERATIONS DIVISION
S W Brown 557

DSAIER SUPPORT DIVISION
M J Billharz 567

SHIPMENT CONTROL DIVISION
E P Chisholm 584

DIRECTORATE OF SUPPLY OPERATIONS
W A WOLLARD, DIRECTOR 508
LT COL R D INGE, USAF, DEPUTY 509

MANAGEMENT SUPPORT OFFICE
B F Clark 553

METALWORKING EQUIPMENT DIVISION
M E Smullen 551

ELECTRONIC AND GENERAL PLANT EQUIPMENT DIV.
H H Karpel 529

MILITARY SUPPORT DIVISION
E L Prince 528

DIRECTORATE OF TECHNICAL OPERATIONS
W M PAYNE, DIRECTOR 661
LT COL H L BJORK, USA, DEPUTY 662

ENGINEERING AND FIELD SERVICES DIVISION
L W Goar 693

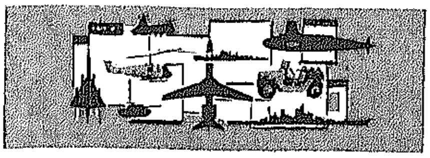
EQUIPMENT IDENTIFICATION DIVISION
R L Myers 689

TENANT ACTIVITY

PROPERTY DISPOSAL BRANCH
HEADQUARTERS AF CONTRACT MANAGEMENT DIVISION (AFSC)
LOS ANGELES, CALIFORNIA 90045

DEFENSE INDUSTRIAL PLANT EQUIPMENT FACILITIES

OPERATIONAL CONTROL	TECHNICAL DIRECTION
DEFENSE INDUSTRIAL PLANT EQUIPMENT FACILITY ATCHISON, KANSAS Fred B Jensen	DDTC TRACY, CALIFORNIA, STOCKTON ANNEX MAJ M K Gray DCSC COLUMBUS, OHIO LT COL R E Benson, USMC DDMP MECHANICSBURG, PENNA. Ray Stine



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of November 1969.

DEFENSE SUPPLY AGENCY

3—Tennessee Overall Co., Tullahoma, Tenn. $1,080,023. 446,660 pairs of men's polyester/wool tropical trousers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-,0-C-0818.

4—OJUS Industries, Inc., Miami, Fla. $1,310,193. 16/,300 rolls of barbed concertina tape. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-2552.

5—Rolane Sportswear, Inc., New York, N.Y. $1,540,003. 107,758 men's cotton raincoats for the Air Force. Ridgely, Tenn., and Hickman, Ky. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-0865.

7—Kingspoint Manufacturing Co., Inc., Fayetteville, N.C. $3,978,951. 96,240 pairs of men's flying coveralls. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-0890.

10—MacLeod Co., Cincinnati, Ohio. $1,090,948. 70 truck-mounted water distributor tanks. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-8171.

14—Pembroke, Inc., Egg Harbor City, N.J. $2,700,199. 85,004 men's Army wool gabardine overcoats, with removable liners. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-0830.

—Major Coat Co., Bridgeton, N.J. $2,643,101. 85,000 men's Army wool gabardine overcoats, with removable liners. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-,0-C-0829.

20—Oscar Meyer Co., Inc., Madison, Wis. $1,038,053. 567,168 twenty ounce cans of prefried bacon. Defense Personnel Support Center, Philadelphia, Pa. DSA 130-70-C-E506.

21—A.N. Ellis Hosiery Co., Philadelphia, Pa. $1,046,533. 1,821,320 pairs of men's socks. Statesville, Granite Falls, Burnsville and Burlington, N.C. DSA 100-70-C-1002.

—Ellis Hosiery Mills, Inc., Hickory, N.C. $1,012,533. 1,800,000 pairs of men's socks. Granite Falls, N.C., and Winchester, Va. DSA 100-70-C-1001. Defense Personnel Support Center, Philadelphia, Pa.

24—South Jersey Clothing Co., Minotola, N.J. $2,868,000. 128,000 men's polyester and wool Army coats. Minotola and Philadelphia, Pa. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-0997.

—M. Lowenstein and Son, Inc., New York, N.Y. $1,196,738. 742,712 white cotton bed sheets. Columbia and Lyman, S.C. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-0988.

26—Pittston Clinchfield Coal Sales Corp., New York, N.Y. $1,082,400. 132,000 tons of bituminous coal for the Army. Clinchfield, Va. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-0137.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

DEPARTMENT OF THE ARMY

3—Lockheed Aircraft Corp., Sunnyvale, Calif. $7,959,678 (contract modification). YO-3A aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-C-0059.

—Wismer and Becker Contracting Engineers, Sacramento, Calif. $5,998,590. Completion of power house and switchyard, Ozark Lock, Dam and Reservoir, Arkansas River. Army Engineer District, Little Rock, Ark. DA-CW03-70-C-0031.

—Texas Instruments, Inc., Dallas, Tex. $3,171,100 (contract modification). Classified. Dallas and Sherman, Tex. Army Mobility Equipment Command, Fort Belvoir, Va. DA-AK02-69-C-0603.

—Lockheed Aircraft Corp., Sunnyvale, Calif. $2,184,758. Design, fabrication, installation, supervision, checkout and operation of the experimental system for the Hudson Moon event. Sunnyvale, Seattle, Wash., and the Nevada Test Site, Nev. Defense Atomic Support Agency, Washington, D.C. DA-SA01-69-C-10026.

—RCA, Burlington, Mass. $1,141,360 (contract modification). TOW test program for the Land Combat Support System. Army Missile Command, Huntsville, Ala. DA-AH01-69-C-1437.

4—Chrysler Motors Corp., Oak Park, Mich. $1,845,638 (contract modification). 1-ton cargo trucks. Warren, Mich. Army Tank Automotive Command, Warren, Mich. DA-AE0/-70-C-0106.

—Olin Corp., East Alton, Ill. $1,322,047. Fin assemblies for M15 4-lb bombs. Marion, Ill. Edgewood Arsenal, Md. DA-AA15-70-C-019/.

5—Brunswick Corp., Sugar Grove, Va. $1,514,501. XM74 66mm rockets. Edgewood Arsenal, Md. DA-AA15-70-C-0139.

—M.C. Ricciardi Co., Alpha, N.J. $1,350,820. Fiber containers for 2.75 inch rocket assemblies. Army Ammuniton Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-X-0181.

6—Raytheon Co., Andover, Mass. $1,470,000. Rebuild accelerators for the Hawk missile system. Army Missile Command, Redstone Arsenal, Huntsville, Ala. DA-AH01-70-A-0002.

—M. M. Sundt, Tucson, Ariz. $1,280,524. Modification and inclosing of an environment shelter, missile launching facility service tower, Vandenberg Air Force Base, Calif. Army Engineer District, Los Angeles, Calif. DA-CA09-70-C-0039.

10—FMC Corp., San Jose, Calif. $3,404,340. Chaparral guided missile carriers. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-1247.

—Sun Battery Co., Inc., Santa Ana, Calif. $1,851,840. 112,000 dry charge batteries for vehicle application. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-2102.

—Vitro Corp. of America, Silver Spring, Md. $1,400,000. Program support engineering services for Project Mallard. Fort Monmouth, N.J., and Silver Spring. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0042.

12—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications:

Hercules, Inc., Wilmington, Del. $6,920,359. Propellants and explosives, and non-production and maintenance activities, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-0037(A).

Olin Mathieson Chemical Corp., East Alton, Ill. $3,245,611. Propellants, and non-production and maintenance activities, Badger Army Ammunition Plant, Baraboo, Wis. DA-AA09-69-C-0014. $33,241,140. Propellants and ammunition components, and non-production and maintenance activities, Indiana Army Ammunition Plant, Charlestown, Ind. DA-AA09-69-C-0148.

Uniroyal, Inc., New York, N.Y. $1,618,872. TNT, and loading, assembling and packing various items, and plant maintenance, Army Ammunition Plant, Joliet, Ill. DA-11-179-AMC-00062(A).

Eastman Kodak Co., Kingsport, Tenn. $12,436,414. Explosives, and plant maintenance and non-production activities, Holston Army Ammunition Plant, Kingsport, Tenn. DA-11-AMC-00036(A).

—Aluminum Co. of America, Pittsburgh, Pa. $5,590,250. 2.75 inch rocket motor tubes. New Kensington, Pa. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0256.

—Norris Industries, Los Angeles, Calif. $3,878,750. 2.75 inch rocket motor tubes. Pico Rivera, Calif. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0244.

—Pace Corp., Memphis, Tenn. $1,240,800. M49A1 surface flares. Memphis, and Camden, Ark. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0137.

—General Motors Corp., Indianapolis, Ind. $827,717. Evaluation, redesign, fabrication and test of an automatic loader for the XM70 combat tank. Indianapolis, and Cleveland, Ohio. Army Tank Automotive Command, Warren, Mich. DA-20-113-AMC-08843(T).

14—Hercules Engine, Inc., Canton, Ohio. $1,442,070 (contract modification). Engineering change orders, LD-465-1C multifuel engine, 2½-ton truck program. Army Tank Automotive Command, Warren, Mich. DA-AE06-68-C-0006.

—Whittaker Corp., Saugus, Calif. $2,924,025. 2.75 inch rocket motor igniters, Mk 125, Mod 5. Saugus and Indio, Calif. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0259.

—Global Associates, Oakland, Calif. $1,776,702 (contract modification). Logistics support, Kwajalien Missile Range, Marshall Islands. Army Safeguard System Command, Huntsville, Ala. DA-HC60-70-C-0001.

—General Motors Corp., Indianapolis, Ind. $7,268,000 (contract modification). M551 Sheridan vehicles. Cleveland, Ohio. Army Weapons Command, Rock Island, Ill. DA-11-199-AMC-00010(W).

—Stevens Manufacturing Co., Evansburg, Pa. $3,400,195. 12-ton 4 wheel semi-trailers. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-1245.

—Booz Allen Applied Research, Bethesda, Md. $2,150,000. Engineering support for Project Mallard. Red Bank, N.J., and Bethesda. Procurement Division, Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0078.

17—Atlas Chemical Industries, Inc., Wilmington, Del. $4,356,159 (contract modification). TNT, and plant maintenance and non-production activities, Chattanooga, Tenn. Army Ammunition Procurment and Supply Agency, Joliet, Ill. DA-11-173-AMC-00531(A).

—Colt's, Inc., Hartford, Conn. $1,234,901. M16A1 and M16 rifles. Army Weapons Command, Warren, Mich. DA-AF03-69-C-0021.

—Hercules, Inc., Wilmington, Del. $1,087,502 (contract modification). Propellants and explosives, plant maintenance and non-production facilities, Lawrence, Kan. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-11-173-AMC-00042(A).

—Zenith Radio Corp., Chicago, Ill. $1,058,000. 2.75 inch rocket fuzes. Army Am-

munition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0193.

18—**Ammann and Whitney,** New York, N.Y. $1,978,874 (contract modification). Architect engineer services in the development of design criteria for tactical structures, and weapon system contractor support for Perimeter Acquisition Radar (PAR) sites, Safeguard weapons system. Corps of Engineers, Huntsville, Ala. DA-CA01-68-C-0018.

—**Airport Machining Corp.,** Martin, Tenn. $1,100,000. Metal parts for 2.75 rocket warheads. Union City, Tenn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0170.

—**Chamberlain Manufacturing Corp.,** Waterloo, Iowa. $1,018,000. Metal parts for 2.75 inch rocket warheads. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0171.

19—**Fruehauf Corp.,** Detroit, Mich. $1,875,020. M674 semi-trailers and components. Derphos, Ohio. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-1246.

—**Raytheon Co.,** Norwood, Mass. $1,666,536. CV1548/G transistorized tactical field units components. North Dighton, Mass. Army Electronics Command, Philadelphia, Pa. DA-36-039-AMC-04878(E).

20—**Philco-Ford Corp.,** Newport Beach, Calif. $16,178,000. Chaparall ground support equipment hardware. Anaheim, Calif. Army Missile Command, Redstone Arsenal, Huntsville, Ala. DA-AH01-70-C-0230.

21—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts for fiber containers:

Consolidated Box Co., Inc., Tampa, Fla. $5,600,300. DA-AA09-70-C-0201.

United Ammunition Container Corp., Philadelphia, Pa. $4,277,100. Atlanta, Tex. DA-AA09-70-C-0203.

Federal Container Corp., Memphis, Tenn. $1,948,100. DA-AA09-70-C-0202.

Paper Tubes, Inc., Buffalo, N.Y. $1,723,110. DA-AA09-70-C-0204.

—**Continental Motors Corp.,** Mobile, Ala. $2,958,650. Remanufacture of LDS 465-1A engine assemblies for 5-ton trucks. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-5206.

—**Hughes Tool Co.,** Culver City, Calif. $2,760,000. Tear down, inspection and repair of crash damaged OH-6A helicopters. El Segundo, Calif. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-A-0017.

—**Ryan Stevedoring Co., Inc.,** Mobile, Ala. $1,191,334. Stevedoring and related terminal services, Pascagoula, Miss. Hq., Eastern Area, Military Traffic Management and Terminal Service, Brooklyn, N.Y. DA-HC21-70-D-0125.

24—**Rohm and Haas Co.,** Philadelphia, Pa. $1,700,000. Solid propulsion technology. Redstone Arsenal, Huntsville, Ala. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0152.

—**General Motors Corp.,** Anderson, Ind. $1,345,026. 52,046 twelve volt storage batteries, type 6TN. Anaheim, Calif. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-2431.

25—**Bell Aerospace Corp.,** Fort Worth, Tex. $1,200,000 (contract modification). Naval air maintenance trainer for AH-1J helicopters. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-C-1928.

26—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Hercules, Inc., Wilmington, Del. $5,849,315 (contract modification). Propellants and explosives. Army Ammunition plant, Radford, Va. DA-11-173-AMC-00037(A).

General Time Corp., LaSalle, Ill. $6,590,282. MTSQ fuzes, M564. Peru, Ill. DA-AA09-70-C-0216.

McGraw Edison Corp., Bristol, Conn. $3,543,284. MTSQ fuzes, M564. DA-AA09-70-C-0217.

Hamilton Watch Co., Lancaster, Pa. $3,365,752. MTSQ fuzes, M564. DA-AA09-70-C-0218.

Chamberlain Manufacturing Corp., Elmhurst, Ill. $1,760,460. Metal parts for 105mm illuminating projectiles. Waterloo, Iowa. DA-AA09-70-C-0213.

—**General Electric Co.,** Burlington, Vt. $2,319,314 (contract modification). Repair parts for XM35 armament weapon subsystem of the UH-1 helicopter. Army Procurement Agency, New York, N.Y. DA-AF03-69-C-0036.

—**Bell Helicopter Co.,** Fort Worth, Tex. $1,093,540. OH-58A helicopter transmission assemblies. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-A-0118.

—**Stevens Manufacturing Co.,** Ebensburg, Pa. $1,583,846. Four wheel, low bed semitrailers. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-1253.

—**Peter J. Sakes, Inc.,** Freehold, N.J. $1,385,324. Pre-engineered commissary sales store building, including air conditioning, utilities and site work, Fort Monmouth, N.J. Army Engineer District, New York, N.Y. DA-CA51-70-C-0031.

28—**American Optical Co.,** Keene, N.H. $2,388,206. Mk 24 Mod 1 target detecting devices for the Chaparral missile. Army Missile Command, Huntsville, Ala. DA-AH01-69-C-1904.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Remington Arms Co., Inc., Bridgeport, Conn. $62,812,306 (contract modification). Loading, assembling and packing small arms ammunition. Lake City Army Ammunition Plant, Independence, Mo. DA-49-010-AMC-00003(A).

Hercules, Inc., Wilmington, Del. $10,152,997 (contract modification). Rocket propellant. Sunflower Army Ammunition Plant, Lawrence, Kan. DA-11-173-AMC-00042(A).

Uniroyal, Inc., New York, N.Y. $20,528,768 (contract modification). Explosives, and loading, assembling and packing ammunition. Army Ammunition Plant, Joliet, Ill. DA-11-173-AMC-00062(A).

Ravenna Arsenal, Inc., Ravenna, Ohio. $4,602,735 (contract modification). Loading, assembling and packing 155mm and 175mm projectiles and components. DA-AA09-70-C-0002.

M.C. Ricciardi Co., Alpha, N.J. $1,332,818 (contract modification). M105A2 fiber containers. Washington, N.J. DA-AG11-69-C-0218.

DVA Corp., Mt. Laurel, N.J. $4,592,000. M125A1 booster metal parts. DA-AA09-70-C-0195.

Etowah Manufacturing Co., Inc., Gadsden, Ala. $4,662,400. M125A1 booster metal parts. DA-AA09-70-C-0190.

I.D. Precision Components, Jamaica, N.Y. $3,504,000. M125A1 booster metal parts. Gadsden, Ala. DA-AA09-70-C-0197.

Brads Machine Products, Inc., Gadsden, Ala. $2,432,000. M125A1 booster metal parts. DA-AA09-70-C-0198.

—**Whittaker Corp.,** Saugus, Calif. $1,812,000. Assembling, loading and packing M505A3 fuzes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0294.

—**Atwood Vacuum Machine Co.,** Rockford, Ill. $1,078,056. M14A1 metallic link belt links for 20mm cartridges. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0295.

—**Goodyear Tire and Rubber Co.,** Akron, Ohio. $4,363,749. T97E2 combat tank track shoe assemblies. St. Mary's, Ohio. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-2489.

—**FMC Corp.,** San Jose, Calif. $1,087,836. M113A1 armored personnel carrier vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-2600.

—**AMETEK Corp.,** Sheboygan, Wis. $1,056,610. Stabilizer rods for 2.75 inch rocket motors. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0284.

—**Vibratronics Laboratories, Inc.,** Bloomingdale, N.J. $2,876,400. M4 electric blasting caps. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0282.

—**Bell Aerospace Corp.,** Fort Worth, Tex. $2,592,980 (contract modification). UH-1H helicopters. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-C-0028.

—**Control Data Corp.,** Minneapolis, Minn. $7,500,000. Classified electronic equipment. Army Electronics Command, Fort Monmouth, N.J.

—**Norris Industries, Inc.,** Los Angeles, Calif. $2,729,157. M148A1B1 105mm cartridge cases. Los Angeles Army Procurement Agency, Pasadena, Calif. DA-AG07-70-C-0347.

DEPARTMENT OF THE NAVY

3—**General Dynamics Corp.,** Groton, Conn. $3,052,200. Studies of fleet ballistic missiles. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0228.

—**Newport News Shipbuilding and Dry Dock Co.,** Newport News, Va. $2,851,200 (contract modification). Preparation of contract design drawings and specifications for the SSN 688 class nuclear powered submarine. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0275 PZ03.

—**General Instrument Corp.,** Hicksville, N.Y. $1,555,738. High reliability battlefield surveillance radar for the Marine Corps. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3502.

—**RCA,** Moorestown, N.J. $2,022,305. High reliability battlefield surveillance radar for the Marine Corps. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3501.

4—**Allen and O'Hara, Inc.,** Memphis, Tenn. $6,136,000. Construction of a 230 bed hospital, Naval Hospital, Memphis, Tenn. Naval Facilities Engineering Command, Washington, D.C. N62467-68-C-0310.

—**Hydrospace Research Corp.,** Rockville, Md. $1,119,521. Sonar array reliability and acoustic performance trials. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1023.

6—**The Magnavox Co.,** Fort Wayne, Ind. $31,044,648 (contract modification). FY 1970 procurement of airborne ASW systems. Naval Air Systems Command, Washington, D.C. N00019-68-C-0497.

—**Lockheed Aircraft Corp.,** Burbank, Calif. $10,000,000 (contract modification). S-3A weapon system. Naval Air Systems Command, Washington, D.C. N00019-69-C-0385.

—**United Aircraft Corp.,** Windsor Locks, Conn. $1,347,440. P-3 aircraft propeller systems. Naval Air Systems Command, Washington, D.C. N0019-69-C-0607.

7—**Admiral Systems Corp.,** Chicago, Ill. $3,680,090. AN/ARC-51 radio sets. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-C-0450.

—**Bendix Corp.,** Mishawaka, Ind. $1,158,894. Talos missile UHF telemetering and field conversion rework kits. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-4309.

10—**Raytheon Co.,** Lowell, Mass. $2,104,700. Modification kits for Sparrow III missiles. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-67-A-0006.

—**McDonnell Douglas Corp.,** St. Louis, Mo. $1,355,094. Replacement parts for F-4J aircraft ejection seats. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00383-69-A-0003.

—**Sperry Rand Corp.,** St. Paul, Minn. $1,107,000. CP-901/ASQ-114 computers. Naval Air Systems Command, Washington, D.C. N00019-70-C-0110.

—**General Dynamics Corp.,** Pomona, Calif. $1,040,400 (contract modification). Standard ARM missile avionics for the Air Force and Navy. Naval Air Systems command, Washington, D.C. N00019-68-C-0074.

—**Hydrodyne Industries, Inc.,** Hauppage, N.Y. $3,020,550. 6,500 shedder seal track section kits for repair and overhaul of LVTP-5 amphibious vehicles. Hq. Marine Corps, Washington, D.C. M00150-70-C-0120.

—**Eagle-Picher Industries, Inc.,** Joplin, Mo. $2,711,348. BB-620/U batteries and other electronic items. Hq. Marine Corps, Washington, D.C. M00150-70-C-0113.

13—**General Dynamics Corp.,** Groton, Conn. $1,984,200. Advance planning, design and material procurement for the overhaul of the USS Sturgeon (SSN 637). Naval Ship Systems Command, Washington, D.C. N00024-70-C-0227.

14—**Treadwell Corp.,** New York, N.Y. $1,

450,960. Refurbishment of oxygen generators for submarine use. Naval Shipyard, Portsmouth, N.H. N00102-70-C-0269.

17—Singer-General Precision, Inc., Little Falls, N.J. $10,363,821. ASN-84 navigational systems for P-3 aircraft. Naval Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3201-0202.

—American Electronics Laboratories, Colmar, Pa. $3,700,000. Classified electronic countermeasures equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1123.

—Hazeltine Electronics Corp., Little Neck, N.Y. $3,474,684 (contract modification). Airborne interrogator sets. Naval Air Systems Command, Washington, D.C. N00019-69-C-0538.

—Todd Shipyards Corp., San Pedro, Calif. $1,593,621. Overhaul of the repair ship USS Hector (AR 7). Supervisor of Shipbuilding, Conversion and Repair, 11th Naval District, San Diego, Calif. N62791-70-B-0020.

—Litton Systems, Inc., Pascagoula, Miss. $229,279,890 (contract modification). Two additional multi-purpose amphibious warfare ships, and long lead time for two other ships. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0283.

18—Vitro Corp. of America, Silver Spring, Md. $1,069,935. Submarine planning and engineering studies. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0214.

19—Goodyear Aerospace Corp., Akron, Ohio. $22,500,000. SUBROC (Mk 28 Mod 1) components. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-1439.

—General Electric Co., Washington, D.C. $1,020,000. Polaris guidance system tactical engineering support. Pittsfield, Mass. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0067.

20—General Time, Inc., Skokie, Ill. $1,214,-489. Rockeye II mechanical time fuzes, plus shipping and storage containers. Naval Air Systems Command, Washington, D.C. N00019-70-C-0141.

—United Aircraft Corp., East Hartford, Conn. $2,868,445 (contract modification). J-52-P-8A engines, engineering data, special support equipment and publications. N00019-67-C-0182. $1,650,000 (contract modification). YTF-30-P-412 engines, publications and ground support equipment. N00019-69-C-0614. Naval Air Systems Command, Washington, D.C.

21—Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $5,000,000. Detail design of the SSN-688 class nuclear submarine. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0238.

—Sylvania Electric Products, Inc., Mountain View, Calif. $2,357,250. Classified electronic countermeasures equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1128.

24—Metals Engineering Corp., Greenville, Tenn. $8,288,276. Mk 82 Mod 1 500 lb. bomb fin assemblies. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A038.

—Poloron Products, Inc., New Rochelle, N.Y. $8,222,291. Mk 82 Mod 1 500 lb. bomb fin assemblies. Batesville, Miss. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A024.

—RCA, Camden, N.J. $3,324,891. Spare parts for P-3C aircraft AN/ARC-142 and -143 radio communications systems. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-C-1817.

—Western Electric Co., New York, N.Y. $1,334,938. Oceanographic research. Whippany, N.J. Naval Electronic Systems Command, Washington, D.C. N00039-69-C-3523.

25—The Naval Purchasing Office, Los Angeles, Calif., issued the following contracts for classified work:
Hughes Aircraft Co., Culver City, Calif. $1,050,000. N00123-70-C-0863.
General Electric Co., Philadelphia, Pa. $1,050,000. N00123-70-C-0862.

26—Bendix Corp., Teterboro, N.J. $2,301,325. A-4F and TA-4J aircraft automatic flight control system components. Teterboro, and North Hollywood, Calif. Naval Aviation Supply Office, Philadelphia, Pa. N00383-069-A-0004-0268.

—Cameron Iron Works Inc., Houston, Tex. $2,238,951. Mk 12 Mod 1 inert guided missile boster and Mk 200 Mod 0 inert igniter assembly. Naval Ordnance Station, Indianhead, Md. N00174-70-C-0014.

—Western Electric Co., Inc., New York, N.Y. $1,720,000. Mk 1 Mod 1 weapon direction equipment. Burlington, N.C. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2304.

—Sperry Rand Corp., Charlottesville, Va. $1,206,738. Ships navigational systems. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5249.

28—Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $26,500,000 (contract modification). Continuation of engineering, procurement, planning and other procurement phases of the nuclear-powered aircraft carrier program. Naval Ship Systems Command, Washington, D.C. N00024-67-C-0325 P023.

—McDonnell Douglas Corp., St. Louis, Mo. $13,500,000 (contract modification). Long lead time funding of F-4E/J and RF-4E aircraft. Naval Air Systems Command, Washington, D.C. N00019-68-C-0495.

—Lockheed Missiles and Space Co., Sunnyvale, Calif. $12,894,000. Operational systems development program for the Poseidon missile. Naval Strategic Systems Project Office, Washington, D.C. N00030-66-C-0186.

DEPARTMENT OF THE AIR FORCE

3—TRW Inc., Redondo Beach, Calif. $5,750,-000. Computer program for Minuteman III. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0114.

—American Electric Inc., Lamirada, Calif. $1,053,854. 750-pound bombs. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-69-C-2206.

4—National Lead Co., Toledo, Ohio. $2,-737,119. Munitions component parts. Toledo, Ohio, and Batavia, N.Y. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42400-70-C-0061.

5—Westinghouse Electric Corp., Baltimore, Md. $1,242,000. Test benches and aerospace ground equipment for F-4E aircraft radar systems. Cockeysville, Md. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F34601-69-A-0034.

—Dynamics Corp. of America, Long Island, N.Y. $1,192,693 (contract modification). Service and supplies for repair/modification and reconfiguration of mobile ground communication systems. Oklahoma City Air Materiel Area, AFLC, Okla. F34601-69-A-0345.

—Honeywell, Inc., Arlington, Va. $1,133,-211. Purchase of installed leased computer systems. Wellesley Hills, Mass. 2750th Air Base Wing, Wright-Patterson AFB, Ohio. F33600-70-F-2235.

6—Lockheed Aircraft Corp., Marietta, Ga. $7,853,358. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF 33657-15053.

7—Sylvania Electric Products, Inc., Needham, Mass. $5,917,950. Operate, maintain and perform minor modification to the missile tracking radar system, Kwajalein atoll. Electronic Systems Division, AFSC, L.G. Hanscom Field, Mass. F33657-69-C-1214.

—General Electric Co., West Lynn, Mass. $1,573,200. Aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1214.

10—Sylvania Electronic Systems, Inc., Waltham, Mass. $6,089,295. Production support of the Minuteman missile ground electronics system and related support items. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0236.

—Space Corp., Dallas, Tex. $1,753,436. A/S 32H-6 trucks. Garland, Tex. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-1211.

13—General Dynamics Corp., Fort Worth, Tex. $66,850,000. F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-13404.

—Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y. $1,135,000. Development, design and fabrication of a variable stability aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33615-67-C-1157.

17—Sanders Associates, Inc., Nashua, N.H. $1,212,100. Electronic countermeasures equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1366.

—Electronic Resources, Inc., Los Angeles, Calif. $1,004,160. Aircraft camera and electronic sensor controls. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0316.

18—Electro-Mechanical Corp., Sayre, Pa. $3,719,627. Transportable shelters for electrical equipment of Tactical Air Control systems. Electronic Systems Division, AFSC, L.G. Hanscom Field, Mass. F19628-70-C-0048.

19—Philco-Ford Corp., Newport Beach, Calif. $3,630,000. Target designator equipment for F-4D aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0345.

—Martin-Marietta Corp., Denver, Colo. $2,-313,740. Design, development, fabrication and delivery of a Titan III space booster. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF 04-695-150.

—Airesearch Manufacturing Co., Los Angeles, Calif. $2,249,623. Electronic components for the F-4 aircraft. Torrance, Calif. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-2377.

20—LTV Electrosystems, Inc., Greenville, Tex. $2,228,507. Inspection and repair as necessary for maintenance, and wing modification of C-133 aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-0739.

21—General Electric Co., Philadelphia, Pa. $5,192,730. Research and development of the Mk 12 reentry vehicle. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF04(694)-478.

—Lockheed Aircraft Corp., Marietta, Ga. $2,221,878. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, Marietta, Ga. AF 33(657)-15053.

24—The Hallicrafters Co., Rolling Meadows, Ill. $1,342,000. Spare parts for the AN/ALT-28 electronic countermeasure system for EB-66E aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F33657-69-A-0014.

—Philco-Ford Corp., Palo Alto, Calif. $1,-200,000. Logistic support of the satellite control network. Air Force Satellite Control Facility, Los Angeles, Calif. F04701-68-C-0000.

26—Hughes Aircraft Co., Fullerton, Calif. $4,-706,833. Engineering, production and test of Tactical Air Control Operations Centers. Electronic Systems Division, AFSC, L.G. Hanscom Field, Mass. F19628-67-C-0154.

—Emerson Electric Co., St. Louis, Mo. $2,-210,207. F-111 aircraft test equipment spare parts. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-68-C-3961.

28—Motorola, Inc., Scottsdale, Ariz. $8,783,540. Bomb proximity fuzes. Armament Test Center, AFSC, Eglin AFB, Fla. F08635-70-C-0202.

—Rohr Corp., Chula Vista, Calif. $1,400,300. C-141 aircraft components. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-1250.

—General Motors Corp., Indianapolis, Ind. $22,094,738. TF-41-A-1 and A-2 turbofan engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-67-0103.

—Lockheed-Georgia Co., Marietta, Ga. $184,-135,100 (allotment of funds). 28 C-5A aircraft in the Run B option. Aeronautical Systems Division, AFSC, Wright Patterson AFB, Ohio. F33(657)-15053.

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Defense Supply Agency (DSAH-B)
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Navy Plans NAVFAC Field Division Changes

The Naval Facilities Engineering Command, Washington, D.C., has announced plans to consolidate its 13 Engineering Field Divisions into 6 larger Field Divisions.

Need for consolidation was brought about by reductions in the FY 1970 budget supporting the divisions. Proposed consolidations include:

- Northeast Division, Boston, Mass., Eastern Division, New York, N.Y., and Midwest Division, Great Lakes, Ill., to the Northern Division, Philadelphia, Pa.
- Gulf Division, New Orleans, La., to the Southern Division, Charleston, S.C.
- Caribbean Division, San Juan, Puerto Rico, to the Atlantic Division, Norfolk, Va.
- Southwest Division, San Diego, Calif., and Northwest Division, Seattle, Wash., to the Western Division, San Francisco, Calif.

No changes were announced for the Pacific Division, Honolulu, Hawaii, and the Chesapeake Division, Washington, D.C.

USAF Enlists "Dynamic Dan" for Ejection Seat Tests

The Air Force has developed a mechanical analog—a model of the mechanical characteristics of the human body—to be used in testing ejection seats and other aircraft escape systems.

Known as "Dynamic Dan," the analog is being constructed for the Air Force System Command's Aerospace Medical Research Laboratory (AMRL), Wright-Patterson AFB, Ohio, by the Payne Division, Wyle Laboratories, Rockville, Md.

Researchers found that normal dummies, when used in ejection seat tests, did not react the same as the human body does; the dummies were rigid, where man is elastic. This elastic motion of the human body can result in adverse tumbling of the seat during ejection.

Dan, however, has a fiberglass skeleton with the same stiffness and weight as live human bones, and rubber flesh presenting the same resistance to deflections as human flesh. Researchers expect Dan to slump and deform the same as man does under the high forces encountered during ejection and separation from disabled aircraft.

Dan's body also represents the aerodynamic drag characteristics of the human body, making him a valuable tool in testing rocket ejection systems. Literally yanking the pilot from the cockpit by his parachute harness, the system has been man rated for use at speeds up to 250 knots; higher speed could be used if the system could be man rated, via reusable Dan.

Air Force researchers also see Dan as the progenitor of more realistic analogs. By incorporating injury fuses, wires, or other breakable elements within each segment of the body, the analog would "break" at the same point of stress a human body would break. The analog's segment would not be destroyed, however; it would only record whether the forces exerted on it were great enough to break the bone or organ represented, allowing reuse.

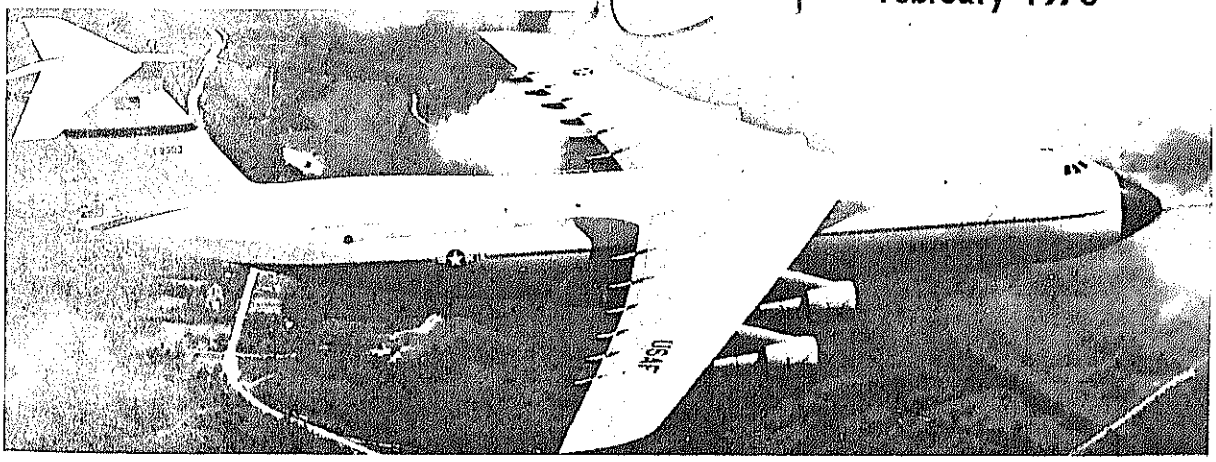
Project engineer is James W. Brinkley of the Biodynamics and Bionics Division of AMRL.

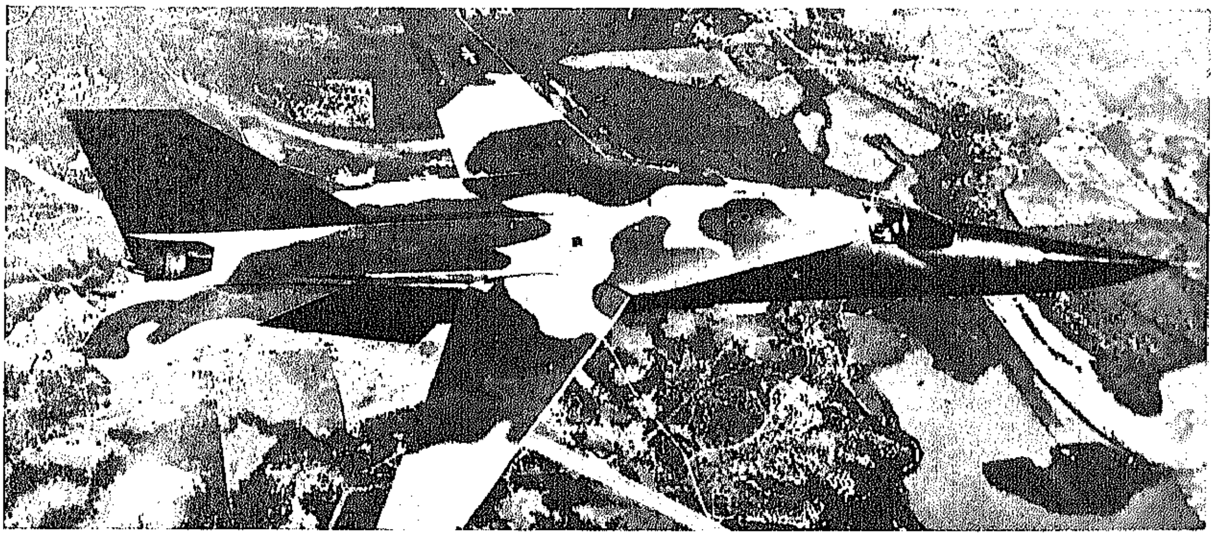
☆U. S. GOVERNMENT PRINTING OFFICE : 1969 393-613/6

DEFENSE INDUSTRY BULLETIN

C-9

February 1970





DEFENSE
INDUSTRY
BULLETIN

Vol. 6 No. 2 February 1970

Published for Department of Defense
by Defense Supply Agency

The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

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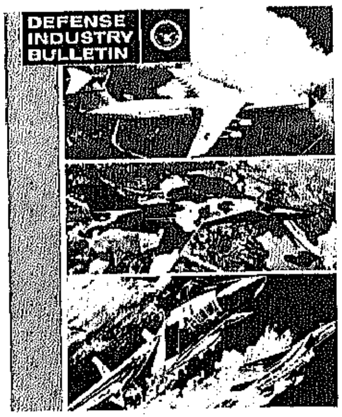


Major systems being managed by the Aeronautical Systems Division, Air Force Systems Command, are the C-5 transport, the F-111 fighter-bomber, and the F-15 air superiority tactical fighter. The Aeronautical Systems Division story begins on page 15 in this issue.

New Subcontractor Cost or Pricing Data Required

Charles Goodwin

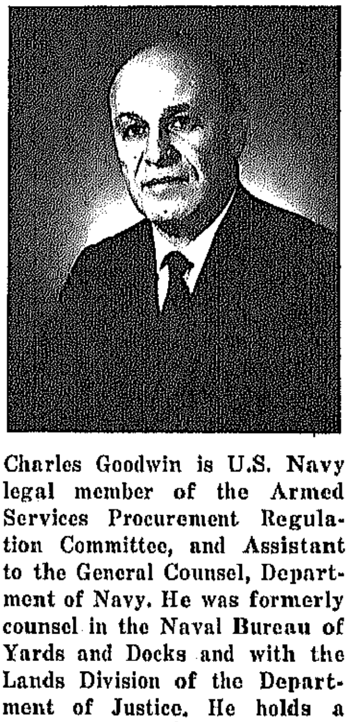
Changes in policy relating to subcontractor cost or pricing data and audit requirements, which became effective on Jan. 1., 1970, were published in Defense Procurement Circular (DPC) No. 74, dated Oct. 10, 1969. The provisions of DPC 74, now in effect, will eventually be incorporated in a future revision to the Armed Services Procurement Regulation (ASPR).

The changes to ASPR policy essentially are to:

- Provide new requirements for obtaining cost or pricing data from first- and lower-tier subcontractors at the time of pricing a prime contract. Exemptions equivalent to those provided by Public Law 87–653 are recognized. Also failure to comply may be excused in exceptional cases, provided adequate alternate arrangements are made.
- Clarify the application of cost or pricing data requirements to contract modifications netting under $100,000, but based on additive and deductive costs aggregating $100,000 or more.
- Provide a guarantee of accuracy—as distinguished from completeness and currency—in cases where only partial cost or pricing data is required.
- Conform the Audit and Records clauses under ASPR 7–104.42 to the Minshall Bill (Public Law 90–512) amendment to 10 U. S. Code 2306(f).

This new policy is actually an extension to Public Law 87–653, commonly known as the "Truth in Negotiations" Act. The law provides that prime and subcontractors be required to submit cost or pricing data prior to award of certain negotiated contracts and subcontracts expected to exceed $100,000. They must certify that the data is accurate, complete and current. The law further protects government interests by requiring inclusion of a Defective Pricing clause in each contract negotiated on the basis of cost or pricing data. This gives the Government a contractual right to a price reduction if the price is increased because of a submission of inaccurate, incomplete, or non-current cost or pricing data.

The provisions of DPC 74 are not a legal requirement, because Public Law 87–653 only calls for subcontractor cost or pricing data at the time of award of the subcontract. Generally, this occurs after award of the prime contract and, literally, the statute does not require subcontractor data when the prime contract is awarded. Nevertheless, legal considerations played an important part in the deliberations of the ASPR Committee in formulating the policy. Public Law 87–653 clearly manifests a Congressional concern with obtaining data



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from subcontractors and it is plainly in keeping with the spirit, if not the letter, of the statute that this data be obtained at a time when it serves a useful purpose to the Government.

DPC 74 was not arrived at lightly. It has been in the making for three years. During the three years, there was repeated consultation and coordination within the Military Departments, and with the General Accounting Office and industry. At all times, two questions were uppermost in the formulation of the new policy: Will it work, and is it worthwhile?

Members of the ASPR Committee know that they have added to the burdens and responsibilities of government contracting officers as well as prime and subcontractors. We did our best to evaluate the pertinent factors. On the one hand no one doubted that it paid to get accurate, current and complete data if the subcontract amounted to $25 million. On the other hand, no one thought it paid for subcontracts under $10,000. Somewhere in between, there was a cross-over point where the costs and complications of getting subcontractor data paid off in better pricing. What was cost effective—$100,000 or $1,000,000? Ultimately, the judgment of the Military Assistant Secretaries fixed that point at $1 million or 10 percent of the prime contract price, whichever is less, provided the subcontract is $100,000.

DPC 74 is not the last word. We expect to watch its impact carefully as suggested by the General Accounting Office. We hope to learn by experience. If it proves bad, it can be cut back. If good, it can be extended.

The goal is still good pricing and data is only one of the elements of good pricing. In the end, good pricing depends on the judgment, experience, techniques, energy, resourcefulness, and personal effectiveness that government contracting officers and industry representatives bring to the process of negotiation. DPC 74 leaves ample scope for discretion, judgment and responsibility. In some respects, the DPC is a design specification, telling what must be done but, in ...spects, it only gives a per... objective—good pricing. ...od pricing is to be achieved is up to the individuals involved—both government and industry.

Definition of Terms

Preliminary to discussing the policy provisions of DPC 74, a definition of terms will be useful to convey some of the basic differences and key concepts under the new regulation.

Contractor data is data that a prime contractor knows. If that data is defective, it is because the prime contractor himself is at fault.

Subcontractor data is the data a subcontractor primarily knows and, if that data is defective, it is because the subcontractor is primarily at fault. All the prime contractor necessarily knows about such data is what he is told by the subcontractor, and not whether it is right or wrong. However, subcontractor data does become contractor data to the extent of the physical package itself. When the subcontractor submits his data to the prime contractor, from that moment on, if there is any mistake in transmission of it to the contracting officer, that is an error or defect in contractor data.

Subcontract data is all data which is relevant to any particular subcontract and that can include *both* subcontractor data and contractor data, *i.e.*, anything the prime contractor knows that would be relevant in respect to a particular subcontract estimate. This can include lower quotes from other vendors; it can include prior purchases; it can even include the prime contractor's own inhouse component production experience data. Maybe he knows what the engineering costs of a particular component ought to be, perhaps just as well as the subcontractor. The point to be emphasized is that the Government needs all information in support of a subcontract estimate—not only the data that is subcontractor data, that comes from the subcontractor. We need *subcontract* data coming from the prime contractor as well.

Actual subcontractor is the man who, at the end of all negotiations, is just about ready to be awarded the subcontract.

Prospective subcontractor is the man who is tentatively selected at the very beginning of cost estimating. He is the man who perhaps has given the prime contractor the best preliminary quote. He is the one with whom the prime intends to conduct further negotiations if he gets the prime contract award and, probably, the one who will receive the final subcontract award.

Certified data, of course, is the data for which the Government gets a certificate saying the data is accurate, current and complete.

Guaranteed data is any data for which the Government has a right to a price reduction under the Price Reduction clause. Guaranteed data includes all certified data, but it includes much more, *i.e.*, it also includes uncertified data obtained by the Government from prospective subcontractors and data of a partial nature.

Old and New Data Requirements

There are in the present ASPR two main categories of requirements for cost or pricing data:

- Category I—Data obtained before *contract* award or modification.
- Category II—Data obtained before *subcontract* award or modification.

Previously, the Government obtained *contractor* data before *contract* award or modification, and it required the prime contractor to obtain *actual subcontractor* data at the time of *subcontract* award or modification. It should be noted that Category II data was obtained only when Category I data was obtained. In other words, a subcontractor never had to submit data unless the prime contractor previously or subsequently had to submit his data.

It should also be noted that under Category I covering contractor data, there were two subcategories: mandatory and judgmental. It was mandatory over $100,000; it was judgmental under $100,000. Under Category II covering subcontractor data, there was no similar choice or judgment. Everything depended upon the kind of a Subcontractor Data clause the prime contract contained. Before making the prime contract award, the contracting officer did have a judg-

ment to make as to whether he wanted data from the prime contractor below $100,000. That judgment, in turn, affected any judgment as to the amount he included in the contract clause for submission of actual subcontractor data in the Category II area.

Note the use of the word judgmental—not optional, discretionary, or anything else to indicate that the contracting officer had a free choice in this matter. He is expected to exercise a judgment as to whether he needs data for good pricing. If he needs it, he is expected to get it. However, the existing ASPR provisions discourage getting data under $100,000 except in the minority of cases, because the cost and time involved are not generally justified by the amount of price benefits.

To the foregoing requirements for getting *contractor* data and *actual* subcontractor data, all that the new DPC does is include an additional requirement for getting *prospective* subcontractor data. The addition is a new subcategory in the Category I area—"before contract award or modification." At that time, the contracting officer is going to get not only contractor data but also prospective subcontractor data when data is required under Category I.

Under the new subcategory for prospective subcontractor data, there are also two subdivisions: mandatory and judgmental. The data is mandatory if the prospective subcontract estimate is over $1 million, or over 10 percent of the estimated prime contract price and also over $100,000. In these circumstances, it is mandatory that the contracting officer get prospective subcontractor data. On the other hand, he has to make a judgment as to whether he needs such data under these mandatory amounts. That judgment applies, generally, with respect to prime contract estimates between $1 million and $10 million. If the prime estimate is over $10 million, prospective subcontractor data will be mandatory in any event for 10-percent subcontracts. If the prime estimate is under $1 million, since 10 percent is less than $100,000, the data for prospective subcontractors will not be mandatory. The contracting officer can request it even then, but it is equally subject to the ASPR provisions discouraging getting data in these circumstances. In any event, the subcontract, generally, will be in an amount between $100,000 and $999,000 for the judgmental area to apply.

The new requirement for prospective subcontractor data is wholly additive. It in no way diminishes the requirements for data under the existing ASPR, either in connection

COST OR PRICING DATA

	I. BEFORE CONTRACT AWARD OR MODIFICATION						II. BEFORE SUBCONTRACT AWARD OR MODIFICATION
	A. CONTRACTOR DATA			B. PROSPECTIVE SUBKRDATA (applicable only when contractor data required)			ACTUAL SUBKRDATA (applicable only when contractor data required)
	(1) MANDATORY Over $100,000	(2) JUDGMENTAL Under $100,000		(1) MANDATORY Over $1,000,000 or over 10% & $100,000	(2) JUDGMENTAL Other SubKs		MANDATORY Over $100,000 but may be less as specified in prime Sub Data Clause
		(a)	(b)		(a)	(b)	
ACC		Id. or	Partial	Id.	Id. or	Partial	Id.
Exemptions		Id.	NA	Id.	Id.	NA	Id.
Waiver		Id.	NA	NA	NA	NA	Id. *
				Excuses	Excuses	NA	
633		Id.	NA	Id.	Id.	NA	Id.
Certified		Id.	NA	NA	NA	NA	Id.
KR Handshake		Id.	Varied	Id.	Id.	Varied	Sub Handshake
Price Red. Cl.		Id.	NA Id.	Id.	Id.	Id.	Id.
Audit Cl.		Id. *	NA	NA	NA	NA	Id. *
Sub Data Cl.		Id. *	NA	NA	NA	NA	Id. *

* Generally Id - Identical NA - Not Applicable NA Changed to Id. by DPC 74

with contractor data or in connection with actual subcontractor data. Even though a prospective subcontractor has submitted his data under this new requirement at the time the prime contract award is made, later on he has to submit it again at the time he actually receives a subcontract award because this is what the law requires.

Under the existing mandatory requirement for getting contractor data, it has to be accurate, current and complete. It is subject to the standard exemptions based upon adequate price competition, established catalog or market price, or price established by law or regulations. Secretarial waiver is sometimes justified and is permitted, but these cases are rare. It has to be submitted on a DD Form 633, and it has to be certified. The effective date of the certification is the date of the prime contract "handshake," the date the contracting officer concludes negotiations with the contractor. After that, the remaining actions necessary might include business clearance, funding, and drafting and executing the formal contract which has to incorporate the Price Reduction clause, the Audit clause, and the Subcontractor Data clause.

With respect to existing requirements for actual subcontractor data, there are exactly the same provisions: accurate, complete and current (ACC), exemptions, waiver, 633 and certification. The subcontract is subject to the Price Reduction clause, the Audit clause and the Subcontractor Data clause. The only difference is in respect to the effective date. This date is when the *subcontractor* walks away from the final negotiations with the prime contractor. In other words, it is the date of the subcontract handshake, rather than the date of the prime contract handshake.

The new mandatory requirements, with respect to getting prospective subcontractor data over $1 million (or over 10 percent), include many of the same elements that the prime contractor has to contend with. Data must be accurate, current and com-
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is *not* subject to an Audit clause or a Subcontractor Data clause, for the obvious reason that there is no existing subcontract at that time to provide a vehicle for inclusion of such clauses. The prospective subcontractor data can be made subject to the Price Reduction clause because that is a clause in the prime contract itself.

No Certificate

Prospective subcontractor data does *not* have to be certified by the subcontractor. We have dispensed with certification to avoid unnecessary paperwork. The statute does not make the Government's right to a price reduction depend upon certification. Certificates are, therefore, not legally necessary. The Price Reduction clause can be drafted in such terms that the prime contractor is responsible for a defect in the data, even though it is not certified by the prospective subcontractor.

Under DPC 74, a new concept has been introduced—the concept of excuses. This is broad enough to encompass the kinds of situations that were previously covered only by waiver, so waiver is not now applicable to prospective subcontractor data. We recognize that there are going to be times when, because of the urgent nature of the procurement or for various other reasons, the prime contractor is not going to be in a position to get a complete package of subcontractor data from his prospective subcontractors. So we have provided for excuses. In order to discourage excuses, though, we make it clear that the prime contractor must have generally complied with the requirement for getting subcontractor data. An excuse will be recognized only in exceptional cases. To further discourage it, we require that an excuse must be approved above the level of the contracting officer. It must be approved by the Head of the Procuring Activity (HPA).

When there is an excuse, consideration of various alternatives to take the place of the prospective subcontractor data is required. The contracting officer can either give the contractor additional time if that is feasible in the light of the procurement or, if that cannot be done, the parties can set that particular subcontract item apart, price the rest of the contract, and hold the missing item out for redetermination, renegotiation, or adjustment on the prime contract price. It will be priced out separately and added to the prime contract price, whenever the contractor can get a subcontract price and supporting data. Hopefully, at least a ceiling will be fixed. Conceivably, it may even be possible for a prime contractor to satisfy the contracting officer that he already has enough in-house data on the basis of past purchases, so that the contracting officer can minimize the risk that would be involved in dispensing with up-to-date subcontractor data. With the approval of the HPA, he can then, without getting data from a prospective subcontractor, make a determination that the overall prime contract price is reasonable. The HPA excuse approval provides a vital link in documenting the file related to the procurement.

In the judgmental areas under the existing and new requirements, the contracting officer can have either accurate, current and complete data, or he can make a judgment that only partial data is required. If the contracting officer decides that he needs accurate, current and complete contractor data, then all the same elements are applicable as in the case of mandatory contractor data—ACC, exemptions, waiver, 633, certification, etc. Equally, if he makes a judgment requiring accurate, current and complete prospective subcontractor data under $1 million, then exactly the same elements apply as in mandatory prospective subcontractor data situations.

On the other hand, if the contracting officer makes a judgment that he only needs partial submission of prospective subcontractor data, then none of the mandatory elements apply. The only exception involves price reduction. Formerly, partial contractor data was not subject to the Price Reduction clause. By virtue of DPC 74, a change has been made calling for a guarantee of such partial contractor data as well as partial prospective subcontractor data. This is accomplished by revision of the Price Reduction clause.

It is emphasized that the existing data requirements have not been

changed in any respect except in this one area where we have introduced a guarantee of partial contractor data. This is wholly additive, and in no way minimizes the existing requirements.

RFP and 633 Flow

When the contracting officer sends a request for proposal (RFP) to the contractor, the contractor has to decide what kind of components he will procure and from what subcontractors he is likely to procure them. He, in turn, makes up RFPs which are sent to his various subcontractors. The same process takes place at the subcontractor level. The subcontractor sends RFPs down to his sub-subcontractors. The new requirements are applicable *not only* to first-tier subcontractors. They are applicable to *all tiers* of subcontractors, as long as they are over $1 million or 10 percent of the *prime* contract price.

Development of 633s and their flowback starts with the sub-subcontractors. They make up the 633s—their data package—and send them to their higher-tier subcontractor. He, in turn, makes up his data package in the form of a 633 and incorporates the data packages he received from his sub-subcontractors. In lieu of submitting a 633 data package, subcontractors can claim exemptions just like the prime, if they can show that their particular components can be priced on the basis of adequate price competition, or catalog or market price. Also, a subcontractor may claim an excuse for the reason that he does not have time or is not otherwise able to get his data package together. All of these subcontractor data packages, claims of exemptions, and claims for excuses flow back to the prime contractor.

The prime contractor then makes up his own 633 data package, incorporating in it the data packages, excuses and exemptions received from his subcontractors, and sends it to the contracting officer. The contracting officer gets one submission, preferably, of a 633 which speaks to all elements of his procurement.

Recognizing that some subcontractors are not going to be willing to submit their cost and pricing data to the prime contractor, provision has been made for their direct submission to the contracting officer. The new regulation states that the prime contractor has to submit, or *procure the submission of*, subcontractor data. Some people have raised the question whether, by using the word "procure," we expect the prime contractor to pay for a submission by the subcontractor. The answer is "No, we do not expect him to pay for it." All we want is to make sure that the prime contractor recognizes that he has the responsibility for obtaining submission of all subcontractor data.

Contracting Officer and 633

When the contracting officer receives the price proposal—the 633 data package, he has to consider whether exemptions are justified and whether the price is supported, notwithstanding the exemption. Similarly, with respect to excuses, he has to make sure that they are limited to exceptional cases, and even consider the possibility of disqualifying the prime contractor. If a prime contractor fails to submit prospective subcontractor data, this may be cause for disqualification. In any event, the contracting officer has to consider whether excuses are justified, whether the prime contractor has supported the missing pricing elements by some means other than prospective subcontractor data, and what his alternate arrangements are. The contracting officer also has to assure that he has received a 633 for each subcontractor who is required to submit a 633, and to consider the necessity for a pre-audit or a review and evaluation of the prime and subcontractor data packages.

Prime Negotiations and Award

What happens at the time negotiations are conducted and completed, and you have a handshake?

The prime contractor is required to update his own submission and all complete subcontractor data to the time of the handshake. Before he signs the certificate, he must assure that nothing has occurred in his own "house" that will render his own data submission noncurrent or incomplete. This is not a new requirement. But, more important than that, he will have to check with his subcontractors to make sure that nothing has happened between the time they originally submitted 633s and the time of the handshake, which renders their data non-current or incomplete as of the time of the handshake. Hopefully, these actions can be expedited by telephone calls, to be followed by written confirmation. Certainly, most experienced subcontractors, who are dealing in subcontracts over $1 million, should be familiar with the new DPC, and should be aware of the fact that they will be called upon to update their first data submission to the time of the handshake.

Is this going to be a practicable problem? We tried to ease the problem by eliminating the need for a certificate. For example, we do not want 42 subcontractors being contacted in writing and required to submit 42 subcontractor certificates of cost or pricing data. A telephone verification will suffice. Certificates are not essential for the protection of the Government if it falls within the mandatory limits, or was specifically required by the contracting officer. In any case, it is the responsibility of the prime contractor to update the subcontractor data to the time of the prime handshake with the Government. This applies, whether the subcontractor data is submitted to the contractor or directly to the Government.

When negotiations are being conducted, the contracting officer may have a question whether more data is needed in the light of the kind of negotiations in progress or, perhaps, in the light of Government changes in components or prime contractor changes in production plans.

When negotiations are completed and the handshake occurs, the contracting officer is going to have to worry about incorporating special arrangements for excuses in the contract, such as a Deferred Pricing clause. DPC 74 calls attention to one type of Deferred Pricing clause that is now in the ASPR for redetermination contracts. When a contract is redetermined, components must be fully priced out at that time, but a clause is suggested for deferring the pricing of one or more components as an excep-

tion. The contracting officer can use that Deferred Pricing clause as a guide to the kind of special provisions he can make for excused components under the DPC.

Over and above everything else, the contracting officer has to make a determination whether the price is reasonable and, ultimately, get HPA approval of subcontractor excuses. To support the excuses, he must show how he priced out the contract in the absence of this data, and also get approval of the deferred pricing arrangements or alternate arrangements he has made to supply this information gap. Normally, these actions occur during the business clearance phase.

Award of Subcontracts

After the award of the prime contract, what happens upon award of actual subcontracts?

It is emphasized that the prime contractor is completely uninhibited with respect to his freedom of action in negotiating subcontracts. He may change his subcontractor. He is not tied down to a particular subcontractor, if for any reason he can get a lower quote from anybody else, or perform the work in-house. He is free to negotiate a lower price. He is free to change his specifications. It will be to his complete advantage to take any of these actions because whatever he saves, as a result of them, goes into his own pocket. The only thing the Government can possibly take away from him is any overpricing of the original prime contract by reason of a defect in a prospective subcontractor's data. That would be the case regardless of any subcontract developments —the prime can still be charged for any excess pricing due to defective data submitted by a subcontractor. There is one exception in the case of the prime contractor changing his subcontract, which will be discussed later.

When the prime contractor awards the actual subcontract, we have a "new ball game." New submission of subcontractor data—a new 633—is required. At this stage the subcontractor data must be certified. That is a statutory requirement, as well as a clause requirement. If it is feasible and saves time, the subcontractor may make a new data submission by making reference to his prior prospective subcontractor 633 submission, but making sure that he updates it. He does not necessarily have to repeat the entire package. He can incorporate it by reference, if that is helpful to him.

It must be made clear that this new submission may give rise to a completely independent price reduction potential on the part of the Government. One price reduction potential arose when the prime contract was awarded if there was any defect in the prospective subcontractor data. A new one arises if award of the actual subcontract is affected by defective data, provided any element of government prime contract pricing follows and is affected by the defective subcontract data.

At the time of subcontract award, the prime contractor will have to consider what kind of a Price Reduction flow-down clause he wants to incorporate in the subcontract for his own protection. Here there is a problem of drafting a clause to cover the old data submission when the subcontractor was merely a prospective subcontractor, as well as the new actual subcontractor data. This is a joint problem for the prime and the subcontractor data. It gets a little bit tricky when there is a difference in price between the estimated subcontract and the actual subcontract. If the actual is lower, is the reduction in price due perhaps to defects in the original data? Or is it due to intervening developments in the market or in production methods, designs, or materials? Or is it due simply to good hard bargaining? So there is a tricky problem of trying to draft a flow-down clause that will discriminate between these various possibilities, and either minimize the right to a flow-down indemnification or, at least, provide appropriate credit for those reductions which represent a shrinking out of the original excess overpricing due to defective data.

Revised Price Reduction Clause

The prior Price Reduction clause provided for a prime contract price reduction because of defective *contractor* or *actual subcontractor* data. These were both tied to the prime contractor's certificate. Under the new clause, provision has been made also for defective *prospective subcontractor* data. This is not tied to a certificate. A guarantee of defective partial data has also been added. This guarantee does not go to accuracy, currency and completeness. It is limited only to accuracy and, here again, it is not tied to a certificate.

Accuracy, Timeliness

Accuracy by itself imparts certain aspects of timeliness and completeness. The data must be what it purports to be, *i.e.*, as represented. If it is represented to be data as of a particular date, it must be current as of that particular date. It does not have to be current to the date of a handshake but, at least, it has to be current as represented. If there is no specific date for the data that is submitted, then presumably there would be the problem of implying a reasonable date. Obviously, if the contracting officer requests overhead data from the contractor and receives it, it is inferred, unless otherwise stated, that it is reasonably current as of the time submitted. It cannot be 10 years old. Equally it should be, within its own limits, complete. If overhead data is requested, the contracting officer is entitled to get complete overhead data. It does not have to be complete as to labor cost or material cost but, at least, it has to be complete overhead data, unless the prime or subcontractor makes it clear that he is only submitting overhead elements of a certain kind.

Certain clarifications have been introduced into the Price Reduction clause. Prior to DPC 74, subcontractor data was tied to the date of the prime contractor's, rather than the subcontractor's, certificate, This has been changed. The language has also been changed to eliminate ambiguity by making it clear that data must be "complete, accurate and current as certified" so that, in the absence of certification, the Government has no more right to expect completeness and accuracy, than it has with respect to currency. The new language is used to make all government rights, because of defects of any kind in contractor data, dependent upon getting the certificate from the contractor.

A provision has also been incorporated dealing with a change of subcontractor. In effect, it tells the prime contractor that, if he changes his subcontractor, the Government will have cost reduction rights for defective estimated subcontractor data only to the extent that he has gotten a lower price from another subcontractor.

To illustrate, if a prospective subcontract estimate is $2 million, and there was $500,000 excess due to defective data, the correct subcontract estimate should have been $1.5 million. Then, if the prime contractor changes his subcontractor and pays more than $2 million, the Government gets nothing back. Equally, if the prime contractor pays less than $1.5 million, the Government gets the entire $500,000 excess pricing back. However, if the new subcontractor's price is $1.9 million then, even though the defective pricing was $500,000, all that the Government gets back is what the prime contractor saves—$100,000—and the same applies down the line when the new subcontractor's price is $1.8 million, $1.7 million, etc. However, if the prime contractor deals with the same subcontractor, then the Government is entitled to the full price reduction. This pertains only when there is a change in subcontractor or the prime contractor makes a decision to perform the work in-house, rather than to subcontract it at all. A caution, however, the subcontract may be covered by a contractual requirement for incorporation into a make-or-buy plan and be subject to certain approvals in that regard.

Odds and Ends

DPC 74 incorporates in the ASPR the kind of provision now found in the Defense Contract Pricing Manual to deal with "ups and downs." If in connection with any contract modification, there are additives and deductives which total in the aggregate more than $100,000, then there is a mandatory requirement for cost or pricing data even though the net result is under $100,000. The deductive can be $70,000 and the additive can be $40,000, for a net reduction of $30,000. However, since $110,000 in costs were involved, the modification is subject to the mandatory cost or pricing data requirement. To clarify any doubts on the subject, it has been incorporated into the Price Reduction clause itself.

There is one qualification. That is when there are a number of modifications and changes, that are completely unrelated and separately priced, so that each could be handled as a separate modification. For administrative convenience, the contracting officer simply "bunches" them together. For example, modification "A" is $50,000, modification "B" is $10,000, modification "C" is $10,000, modification "D" is $50,000. If all those modifications have been priced separately in contract negotiations, then the mere fact that they are grouped together and formalized with one change order, and the total goes over $100,000, does not make the formal change order the requirement for cost or pricing data. It is as if there were four, or five, or six separate formal modifications. However, if during negotiations all of these modifications are grouped together and an overall price is set for three, four, five, or six modifications, and each has not been priced separately, then the final "lump sum" modification is subject to the "ups and downs" requirements.

The Audit clause has also been changed to adapt it to the new Minshall Bill, which has some language slightly different from the ASPR. Also, reference to cost contracts has been eliminated, and it has been made clear, with respect to the subcontract flow-down clauses, that they apply only in connection with a modification that the prime contractor has been subjected to. Essentially, all that was done was to clarify or eliminate some things that were oversights on previous revisions.

The last point of discussion is the effective date of the DPC 74. It became "effective" on Jan. 1, 1970, and that is a term of art which is defined in the ASPR itself to mean that the DPC applies to new requests for proposal initiated on or after Jan. 1, 1970. If a request for proposal was initiated before that date, the mere fact that negotiations continue after Jan. 1, 1970, does not call for mandatory application of the new DPC 74 requirements which changed prior regulations.

The discussion in this article has compared the new DPC requirements with the previous provisions in the ASPR with respect to submission of *contractor* or *actual subcontractor* data. We have examined the new DPC 74 requirements for getting *prospective subcontractor* data at the time a contract award or modification is made, plus the changes in the Price Reduction clause with regard to a guarantee of any partial data as well as prospective subcontractor data.

Again, I want to say that DPC 74 is not the last word. We are going to have to continue wrestling with the problems of Public Law 87–653, and refine our policy as we go along. We will welcome constructive criticism, suggestions and support from industry representatives who are affected by these policies formulated by the Defense Department.

Army to Use NASA Low-Speed Aviation Research Facilities

The Army Materiel Command (AMC) and the National Aeronautics and Space Administration (NASA) have agreed to the joint use of NASA test chambers, wind tunnels and other facilities by scientists and engineers for the conduct of low-speed aviation research.

More than $100 million is expected to be saved by the agreement through the elimination of separate low-speed aviation research facilities the Army would need.

Under a similar agreement in 1965, the Army Aeronautical Research Laboratory was established at the NASA-Ames Research Center, Moffett Field, Calif. The new agreement expands the Ames effort, and establishes similar arrangements at the Langley Research Center, Hampton, Va., and the Lewis Research Center, Cleveland, Ohio. A total of 175 Army personnel, civilian and military, will be assigned to the three facilities.

The new agreement will allow the Army to increase studies in the areas of helicopter research, rotor blade aerodynamics and structural dynamics, V/STOL aircraft wind tunnel effects, STOL model tests, and parachute performance, deployment and environment tests.

RESEARCH REPORTS

Organizations registered for service may obtain microfiche copies of these documents without charge from:
Defense Documentation Center
Cameron Station
Alexandria, Va. 22314

All organizations may purchase microfiche copies (65¢) or full-size copies ($3) of the documents (unless otherwise indicated) from:
Clearinghouse for Federal and Scientific Information
Department of Commerce
Springfield, Va. 22151

Function of Adhesion Promoters in Adhesive Bonding. Naval Research, Laboratory, Washington, D. C., June 1969, 18 p. Order No. AD 694 004.

Aircraft Engine Noise and Sonic Boom. Office of Naval Research, Branch Office, London, England, Aug. 1969, 21 p. Order No. AD 694 964.

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Use of Binomial Graphs for Quick and Accurate Approximations of Hypergeometric Sampling Problems. Naval Ammunition Depot, Crane, Ind., Aug. 1969. 81 p. Order No. AD 694 006.

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The Moon. Defense Documentation Center, Alexandria, Va., Sept. 1969, 239 p. Order No. 694 500.

How To Analyze 2-D Schlieren Photographs To Obtain the Density Gradient Structure of 3-D Flow Fields. Naval Ordnance Laboratory, White Oak, Md., April 1969, 33 p. Order No. AD 694 469.

Aerodynamics of Rotary Wing and V/STOL Aircraft. (Proceedings of Symposium Co-sponsored by Army Aviation Materiel Laboratories and Cornell Aeronautical Laboratory, Inc.):

Volume I: Rotor/Propeller Aerodynamics Rotor Noise, June 1969, 336 p. Order No. 693 246.

Volume II: Wind Tunnel Testing New Concepts in Rotor Control, 312 p. Order No. 693 247.

Volume III: Panel Session on Recommendations for Future Aerodynamic Research, Panel Summaries and Featured Speakers, 137 p. Order No. 693 248.

Evaluation of an Acrylic Coating for Self-Luminous Paint. Army Mobility Equipment Research and Development Center, Ft. Belvoir, Va., June 1969, 22 p. Order No. AD 690 807.

Computer Graphics Techniques for Structural Shell Analysis. Air Force Systems Command, Wright-Patterson AFB, Ohio, July 1969, 63 p. Order No. AD 694 077.

Mechanical Considerations in Fracture Characterization of Narrow Gap Weldments. Naval Research Laboratory, Washington, D. C., April 1969, 17 p. Order No. AD 687 402.

Evaluation of the Griplet Terminal. Naval Avionics Facility, Indianapolis, Ind., May 1969, 21 p. Order No. AD 689 787.

GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from:
Superintendent of Documents
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Washington, D.C. 20402

Management of Contractor Data and Reports, Policies and Procedures. Announces policies, assigns responsibilities, and prescribes management procedures established to identify, select, acquire, control, and keep to a practical minimum the essential data required by the Air Force from defense contractors. 1969. 48 p. D 301.45/14: 310-1/2v.1. 60¢

The Management of Value Engineering in Defense Contracts, Department of Defense, Joint Course, Volume 2. Provides uniform instruction in value engineering program management for DOD personnel who are responsible for managing, negotiating, reviewing, or approving value engineering efforts. 215 p. D 1.6/2:V 24/v.2. $2

Changes to "MILSTRIP" Supplement No. 2, Military Assistance Program Address Directory, Nov. 1, 1968.

Change No. 3A, April 1969. 27 p. D 7.6/4:M59:supp.2/rev.2/ch.3A. 25¢

Change No. 3B, May 1969. 13 p. D 7.6/4:M59/supp.2/rev.2/ch.3A 25¢

Change No. 3C, May 1969. 12 p. D 7.6/4:M59/supp.2/rev.2/ch.3C. 15¢

Change No. 4, May 1969. 134 p. D 7.6/4:M59/supp.2/rev.2/ch.4. $1.25

DEFENSE PROCUREMENT CIRCULARS

Distribution of Defense Procurement Circulars is made automatically by the U.S. Government Printing Office to subscribers of the Armed Services Procurement Regulation (ASPR).

Defense Procurement Circular No. 75. Dec. 10, 1969. (1) Restriction on Independent Research and Development, Bid and Proposal and Other Technical Effort (Section 403, Public Law 91-121). (2) Small Business Size Standard. (3) Carriage of DOD-Generated Cargo by Privately-Owned U.S. Flag Vessels. (4) Index of 100 Companies which Received the Largest Dollar Volume of Military Prime Contracts—FY 1969. (5) Small Business Concerns. (6) Mandatory Use of GSA Sources for Repair Services. (7) Preparation, Storage, and Intra-Area Movement of Personal Property, ASPR Section VII, Part 16. (8) DD Forms 1706 and 1707. (9) Military Standard Contract Administration (MILSCAP). (10) Control of Government Property in Possession of Contractor.

Managerial Talent for Emergencies

Lieutenant Colonel Allan R. Zenowitz, USAR

Three times within our memory wartime emergencies have caused the nation to conduct a rapid and costly search for key executives to help provide leadership, guidance and staff for an expanded Federal Government. Time and geography were on our side then. Now, in the thermonuclear, intercontinental ballistic missile age, time and space compression require the nation to have leadership and managerial talent on standby reserve.

To meet this potential emergency need for talent, the President and the Congress created the National Defense Executive Reserve (NDER), citizen leaders from the private sector who stand ready to answer a Presidential call to serve. The NDER is the historical successor to the thousands of executives, from the private sector, who staffed many national government agencies during two world wars and the Korean emergency. The NDER was established by Presidential executive order in 1956 and strengthened in 1964 by a new executive order. It is a government-wide corps under the central management and direction of the Office of Emergency Preparedness, with units in eight departments and agencies having mobilization responsibilities. Current strength is about 4,400 executives.

NDER is organized to meet two types of mobilization threats:

- Limited war.
- General or nuclear war, when we would be forced to decentralize the leadership of Government and, with it, management of the nation's resources.

The Vietnam war has required neither controls over the country's economy, nor additional staffing of federal agencies. A more extensive limited war could lead to a gradual mobilization of the National Defense Executive Reserve. In case of a nuclear attack, executive reservists would report to predesignated mobilization headquarters to perform their emergency assignments.

There is a continuing effort to enroll qualified executive reservists from business, government, labor, agriculture, the professions and the academic community. Because of the extraordinary authority executive reservists might exercise over the nation's total resources, they are chosen for their judgment, prudence, experience and character, as well as technical and professional capability.

NDER members are selected and designated by heads of federal departments and agencies. Candidates are recruited by federal officials and are generally nominated by business, professional, labor and other groups. Volunteers also account for some of those designated.

Candidates must pass a security background investigation.

An executive reservist and his employer sign a statement of understanding, indicating that the reservist will be available to receive peacetime training and that he will report for federal employment in event of an emergency.

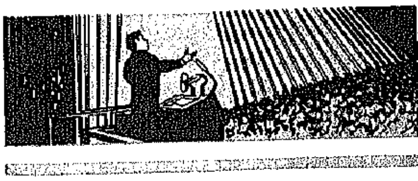
The NDER training program is planned to avoid undue demands on the executive reservist's time. It is scheduled so that the yearly demand on his time is only a few days. Training includes regional and national conferences on broad aspects of mobilization, and unit training sessions that concentrate on individual agency programs. Executive reservists also participate in discussions with federal officials on specific mobilization problems. Test exercises are included in the executive reservists' training program. Reservists receive no pay for pre-emergency training. When called to duty in an emergency, they will become federal employees and may be paid under salary schedules then in effect.

Membership in the military Ready Reserve normally precludes designation as an executive reservist.

Assignments in the NDER are for three years and may be renewed. Recruitment is concentrated on the 35–55 age group, with termination compulsory at age 70.

The Office of Emergency Preparedness, Executive Office of the President, Washington, D.C. 20504, can furnish complete information about the NDER.

Lieutenant Colonel Allan R. Zenowitz, USAR, holds a mobilization assignment with Defense Supply Agency. He is Director, Massachusetts Civil Defense Agency, and President, National Association of State Civil Defense Directors. He holds a bachelor of arts in government from University of Connecticut, and a juris doctor from New England School of Law.



FROM THE SPEAKERS ROSTRUM

New Challenges Ahead in Aircraft Structural Integrity Program

General James Ferguson, USAF, is Commander, Air Force Systems Command, with responsibility for providing the weapon systems and meeting the technological needs of the total Air Force mission. Before assuming his present command, General Ferguson served as Deputy Chief of Staff for Research and Development at Headquarters, U. S. Air Force.

Excerpts from Keynote Address by Gen. James Ferguson, USAF, Commander, Air Force Systems Command, at Air Force Fatigue and Fracture Conference, Miami Beach, Fla., Dec. 15, 1969.

. . . Thanks in great part to what our laboratories—military in-house, university and industrial—have achieved in materials, structures, flight dynamics, propulsion, guidance, avionics, and other disciplines, we have what really amounts to a renaissance in aircraft. The YF–12, SR–71, F–111, C–141 and C–5 are only a few examples of the advances that have already been accomplished. Each represented an entirely new order of capability over previous tactical, strategic and airlift aircraft. Now we have started to develop the F–15 air superiority fighter, the B–1 advanced bomber seems to be getting off the ground at last, and approval for such advanced programs as the airborne warning and control system (AWACS) and a light intratheater transport (LIT) seems favorable.

All of these types, whether in production, test, development, or the exploratory stage, will make greater demands upon you than anything within previous experience. These aircraft will be either faster, higher flying, longer ranged, increased in carrying capacity, operating in extremes of environment, extremely maneuverable, or any combination of these. The engines, similarly, will operate in a wide variety of pressure, temperature and altitude regimes.

So it is quite obvious that considerations of fracture and fatigue will be increasingly more vital. In that connection, Air Force Systems Command is charged with implementing Aircraft Structural Integrity Program requirements as an integral part of the total weapon system research and development and acquisition cycle, from contract definition right through to final procurement.

In order to fulfill this responsibility, we will have to have a good deal of technological advancement in the areas of materials development, service loads, structural analysis, reliability, testing and nondestructive inspection, to name only a few.

So you see, your work is really cut out for you; you will certainly find no lack of challenge in the years ahead.

I would like to be able to assure you, then, that you will also find no lack of resources with which to meet that challenge. That, unfortunately, is not very likely to be the case. . . .

The causes for the present anti-military climate are numerous, divergent and, sometimes, only marginally related. Nonetheless, military and military-related activities present such a large and obvious target that all sorts of diverse dissatisfactions converge upon the man in uniform and all those in any way associated with him. This situation underlies a number of very curious ironics.

First, if nothing succeeds like success, success in the case of military research and development would appear to have succeeded a little too well. Certainly, a strong case can be made that the so-called "military/industrial complex" has helped the United States to survive, and to grow and prosper in a hostile world. But the very essence of art, it is said, is to hide the labor that went into its creation. So, having succeeded so well in countering every threat to our national security, we have perhaps made it seem that there *is* no threat, or that we are eternally immune from any external threats. Thus a large part of the American people would seem to feel that external pressures have been relieved, and they turn more attention to the internal pressures in our society.

. . . In the years when the people *were* very sensitive to the dangers of nuclear war, and of the threat from the USSR and China, our nuclear superiority was overwhelming. Technologically, we were far ahead of the Soviets, and Red China had no means of posing any threat to the United States.

So we have, as I say, perhaps succeeded too well. We made it seem

almost too easy to be superior and safe. And just at the time when that safety and superiority are most threatened, some of the people seem to have turned their backs on the danger. . . .

U.S. Superiority Threatened

Dr. John S. Foster Jr., Director of Defense Research and Engineering, expressed a very possible outcome in a speech last summer. "Now here is my concern:" he said, "research and development funds may well be reduced and then confined for the foreseeable future to some lower level. This trend faces us just as the Soviet Union has pulled roughly even with the United States in the amount of effort put into defense-related research and development. Furthermore, the Soviet Union is increasing its efforts at a disturbing rate. Therefore, the United States in the future may well see superiority in defense technology pass to the Soviety Union."

As it developed, Dr. Foster was not whistling up phantoms. Later in his address, for example, he said, "A logical national decision would be to increase our research and development effort in order to continue our insurance against technological surprise. The new administration wants to do this. The President is requesting an increase in defense research and development of almost seven percent over last year, despite a two-billion dollar overall decrease in the Defense budget recommended by the previous administration."

That, of course, was encouraging. But the hope, as you are probably aware, did not live very long. First the military authorization bill was debated an unprecedented 10 weeks in the Senate—as against the usual 2 or 3 days of previous years. This, of course, was only for *authorization* not for the appropriation of any actual funds.

The House of Representatives moved a little more quickly and was somewhat more liberal with the figures. But, when the two houses received the compromise conference bill, research and development authorizations for the Services had been cut *11 percent below* the level requested by the Administration. In addition, Title II, Section 203, of the bill reads:

> **None of the funds authorized to be appropriated by this Act may be used to carry out any research project or study unless such project or study has a direct and apparent relationship to a specific military function or operation.**

That provision, I am afraid, is so open to divergent interpretation as to be, potentially, severely restricting. While it would seem to apply more to basic than applied research, it *could* very well result in limiting a good many of our research and development projects. It would be very interesting, in fact, to track back and see how many of today's operational or near operational developments originated in studies and projects that, at their inception, appeared to have very *little*, if any, direct military application.

In any event, we see that Dr. Foster's fears have been realized. Nor can we take any genuine comfort from the fact that, on the whole, the Congress dealt rather kindly with the military procurement authorizations. Many of the Senate votes, you will recall, were uncomfortably close. There is every indication that the years ahead will see the momentum build up. At the same time, we know with reasonable certainty that the Administration will be requesting a lower level of funding for defense. So the pressures for reduction will be coming from both the Executive *and* Legislative branches.

I can only promise you, then, that we all face some lean years in the foreseeable future. Yet our responsibilities will not diminish; if anything, they are increasing, and particularly in view of the pace at which the Soviets are pursuing technological progress.

. . . while we have an embarrassment of riches in approved programs, we are more than likely to suffer an embarrassment of poverty in the resources necessary to carry them out.

I think you can see, then, what the climate is today, and what it will most probably be for some time to come. The President has set the tone and supplied the dominant themes—decentralization of authority, more selectivity among technological possibilities, and better defined goals and priorities. He has pointed out a new way of doing business, but it is very clear that both he and the Congress expect it to be done with less money.

Secretary Laird, his deputy, Mr. Packard, and Dr. Foster have pledged, in turn, that there will definitely be less risk-taking in the acquisition and production of major systems, and that development and production will be decoupled, with meaningful milestone decision points acting as the buffers.

Minimize Risks

This means that risk-taking on large systems and large expenditures is going to be at a minimum. The base line of exploratory development—even though 6 to 15 years from initial inventory—is going to have to be narrowed. In advanced development, we will be called upon to demonstrate *feasibility* of certain subsystems to a much greater degree than ever before, in order to reduce the risks on systems that may take advantage of such technology. Each of these "high order" demonstrations, in turn, will consequently require more resources than we might normally expect to apply to an advanced development program. We know, therefore, that few items will be able to reach the demonstration stage.

As far as the laboratories are concerned, I feel that our Technology Needs Program, and our greater emphasis on sound mission and system analyses, will help us to achieve the long-range foresight that will be necessary to put our diminishing resources on the right items.

Those of you in the laboratories—whether our own Air Force laboratories or those university and commercial facilities with which we contract—obviously have your work cut out for you. *Realism, selectivity, feasibility*—these are the characteristics of the operative environment for some time to come.

My long years in the management of military research and development have convinced me completely of the necessity and value of the laboratories; they have impressed me with the caliber of the people and the superb quality of the work; and, above all, they make me wish that I

could give free rein to the creative and innovative spirits that have made our laboratories great.

Unfortunately, for the many reasons I have outlined, this is not possible. Along with the scientific and engineering disciplines in which each of you works, there is now the added discipline of increasingly limited means. I would ask, therefore, specifically of those of you in the Air Force Systems Command laboratories, that you enter into a broadened and continuing dialogue with the systems divisions—Aeronautical Systems Division, Electronic Systems Division, and the Space and Missile Systems Organization—and especially with the system program offices. Again, your relationship must be carried out in terms of realism and selectivity.

There is also a need, as you are probably aware, to be especially articulate in communicating with the program managers—in justifying your projects and the need for them. After all, they are faced with a very definite ceiling on expenditures, and in this climate of realism and selectivity you might naturally expect them to place more value on the "bird in hand" than those "in the bush." The burden, then, is upon *you*, to *convince* them that you offer something measurably superior to what is already in hand. This is no small burden, because without the ability to be convincing in this respect, the very genuine value of your basic work might be only academic.

In summary, the future promises to be difficult. Our potential adversaries are pushing on all the frontiers of technology. We cannot safely do less, and yet we must achieve our technological goals with less in the way of money, manpower and facilities. This is the ultimate challenge to our ingenuity, our creativeness, our sense of realism, and our managerial competence.

One thing we can clearly predict: with the smaller force structure we know is ahead, and with all resources limited, each of our aircraft will have to be better, more capable, stronger, more durable and, preferably less costly. That is a huge order. . . .

Value Engineering Contract Clauses

Excerpt from address by Emanuel Kintisch, Chief, Procurement Management Review Division, Office of Asst. Secretary of the Army (Installations & Logistics), at the Government-Industry Value Engineering Seminar, Gaithersburg, Md., Dec. 8, 1969.

* * * * *

It is my purpose to tell you about the coverage of value engineering in the Armed Services Procurement Regulation (ASPR), and to offer some advice and guidance in your application of the ASPR coverage for our mutual benefit—you, the contractor, and we, the Government.

. . . Let us, then, together skim through the provisions of Part 17, Section I, of the ASPR, highlight the more significant areas, and look at examples of their use. I will start by describing "value engineering" in the language of the ASPR:

"Value engineering is concerned ... elimination or modifica- ...ing that contributes a contract item or ...sary for ... quality, ...ty, or interchangeability. Specifically, value engineering as contemplated by this Part constitutes a systematic and creative effort, not required by any other provision of the contract, directed toward analyzing each contract item or task to ensure that its essential function is provided at the lowest over-all cost. Over-all cost may include, but need not be limited to, the costs of acquiring, operating, and logistically supporting an item or system."

All contracts, including letter contracts, of sufficient size and duration to offer reasonable likelihood for cost reduction, are required to have Value Engineering clauses. These clauses offer a share in the savings resulting from properly documented cost reduction proposals submitted under a contract, even though they do not result from formal value engineering efforts. There are two kinds of clauses which deal with value engineering efforts by contractors: the Incentive clause and the Program Requirements clause.

The contractor is under no obligation to engage in value engineering efforts under the Incentive clause and he does not receive any benefits until he submits a proposal and it is ac-

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cepted. But the Program Requirements clause requires that he will engage in value engineering efforts to the extent stipulated as a line item in the contract schedule, for which he will be paid his costs to the extent of the line item price and additional incentive benefits stipulated in the clause.

The first important thing to note is that if there is no contract there can be no value engineering change proposal; and without such a proposal there can be no contractual sharing of benefits. Let me hasten to add that cost reduction proposals can be submitted as unsolicited proposals, which have to be treated on a case-by-case basis. ASPR Part 17 value engineering procedures and clauses do not apply in such cases.

Obligations and Rights

The next thing to note is that when a contractor submits a proposal under either contract clause, he has certain obligations and certain rights. Among his obligations, he is required to describe his proposal in writing in sufficient detail to permit intelligent review, technically and financially. The writing can be in any form or format which will accomplish the purpose, but it must state the minimum information set out in the clause:

- Description of the difference between existing requirements and the proposed change—with the comparative advantages of each.
- Statement of the contractual requirements to be changed and recommendation of the suggested revision.
- Estimate the reduction in performance costs, taking into account the contractor's costs of development and implementation.
- Estimate collateral savings.
- Statement of the time by which the change order adopting the proposal must be issued to obtain maximum cost reduction.
- Information on any previous submissions of the proposal and the actions by the Government thereon.

If technical data is submitted and the contractor wants to protect it from unauthorized use, he has to mark it in accordance with paragraph (h) of the clause. If he wants to assure its consideration in a timely manner, he should stipulate the period in which the Government must accept or reject the proposal.

On the other hand, the contractor acquires certain rights when he submits a value engineering change proposal. Among these are:

- Objective and expeditious consideration of the proposal by the Government.
- Prompt information on its disposition.
- Entry into a contract modification providing for a price adjustment following the sharing formula for instant contract savings, and for payments for future and collateral savings.

Objective: Cost Reduction

The objective of a value engineering incentive provision is to encourage the contractor to submit cost reduction proposals. To be acceptable, a value engineering change proposal must involve some change in the contract specifications, purchase description, or statement of work. This may include the elimination or modification of any requirements found to be in excess of actual needs in the areas of, for example, design, components, materials, material processes, tolerances, packaging requirements, technical data requirements, or testing procedures and requirements, and consequent reduction in the contract cost. Furthermore, even when the contract cost may be increased, the incentive provisions encourage contractors to submit value engineering change proposals that are likely to lead to overall savings resulting from significant net reductions in collateral costs of government-furnished property, operational requirement, or logistic support requirements.

The proposal can cover any contract requirement, even if it means termination, in whole or in part, of a contract line item. This is not generally understood. . . . in a cancellation of the whole requirement and the termination of the contract [resulting from a value engineering change proposal], the contractor [is] entitled to share the savings computed on the basis of the stipulated contract price.

. . . If he . . . were to propose that 9/10ths of [the items] be cancelled from his contract, he would be entitled to claim his share of the savings from a partial termination.

In the absence of a Value Engineering Incentive clause and proposals thereunder, the Government can terminate the contracts or reduce the contract amount, without any compensation to the contractor.

A Value Engineering Program Requirement clause obligates the contractor to engage in value engineering of the scope and at the level of effort required by the Government as an item of work in the contract schedule. In addition, the clause contains value engineering incentive features which provide for the contractor to share in savings resulting from the acceptance of any value engineering change proposals, whether or not such proposals result from the value engineering program requirement (except when the contract also includes the Incentive clause).

The principal reason for requiring a value engineering program is to get early results, *i.e.*, in the initial stages of design, development, or production, so that specifications, drawings, and production methods will reflect the full benefit of value engineering. The value engineering program requirement, which is set forth in the contract schedule as a line item and separately priced, may apply to all or selected phases of contract performance, and should be tailored to the particular contract situation.

A Value Engineering Incentive clause is required to be included in all contracts, advertised and negotiated, over $100,000, with certain exceptions, and may be included in contracts of $100,000 or less at the discretion of the contracting officer. In my opinion, a contractor would be wise to ask for a Value Engineering Incentive clause to be incorporated in his contract even if there is no potential for savings in that particular contract, but where there may be potential for savings in future contracts or savings in collateral areas: reduced cost of government-furnished property, operational requirements, or logistic support requirements.

While it is Defense Department policy to include Value Engineering clauses—and generally they are—the alert contractor will assure that a

Value Engineering clause is included in every contract where it is not prohibited by ASPR and where it may do him some good; and he will question any discretionary exclusion of such a clause. The validity of this advice is evidenced by the fact that the employment of value engineering in defense contracting is and ought to be understood to be a potential for additional business for the contractor. ASPR makes this crystal clear in a short sentence which reads:

> **"The sharing of cost savings with a contractor under a value engineering incentive or program arrangement constitutes payment for services rendered and does not constitute profit or fee for purposes of the statutory limitations imposed by 10 U.S.C. 2306(d)."**

A related bit of advice is this: Start thinking in terms of value engineering as early in the procurement process as you can. Once you succeed in getting a contract with a Value Engineering Incentive clause, spend some time on value engineering in your production planning. This will give you the opportunity to submit proposals for changes early and to have them apply to as large a part of the production quantity as you can, thereby maximizing the base on which incentive sharing can apply.

Types of Savings

There are three types of savings in which the contractor can share under a Value Engineering clause. These are savings realized on the instant contract, on future acquisitions within a specified period of time, and in the area of reduced collateral costs.

"Instant contract" means the contract as it exists at the time of the acceptance of a proposal—increases in quantity by additional buys or by exercise of options are treated as "future acquisitions" for which the sharing is at a lower rate. The gross savings which result from a value engineering change proposal are subject to being reduced by the costs of developing the proposal, and the costs of implementing the proposal to arrive at the net savings to be shared by the contractor and the Government. The contractor's cost of developing the proposal, if they are properly direct charges to the contract, are deductible to the extent that the development costs have been incurred after the specific value engineering project has been identified. It should also be remembered that developmental and implementing costs of subcontractors and the cost reduction sharing portions of subcontractors, which pertain to the proposal, are treated as part of the contractor's costs for the purpose of computing equitable adjustments of prime contract prices.

Documentation Is Important

Here is where documentation is important. An audit trail has to be established so that the costs thereafter incurred can be charged to the value engineering project. This is no more than good cost accounting practices dictate, where costs are allocated to designated cost centers. Implementation costs are considered to be those costs of incorporating a change, which are incurred after the value engineering proposal has been accepted by the contractor.

"Future acquisitions" for which savings are also to be shared are all those which follow the acceptance of a proposal for a stipulated time of from one to three years. Payments to the contractor on account of those savings can be made in a "lump sum" where the future requirements can be realistically estimated on some firm basis, or in royalty payments, based on actual buys during the stipulated period.

"Collateral savings" are any ascertainable net reduction in the Government's overall projected costs including but not limited to cost of operation, maintenance, logistic support, and government-furnished property. When such collateral savings result from the change proposal submitted by the contractor, he is entitled to participate in the savings.

Extent of Sharing

Generally, incentive clauses provide for the contractor's share of savings to be no less than 50 percent nor more than 75 percent of savings under the instant contract. It takes determination by the head of the purchasing office to go under 50 percent. While his determination is not appealable, it is at least arguable. You have the right to try to change his mind.

Savings on future acquisitions are shared with the contractor at 40 percent for a one-year period, 30 percent for a two-year period, and 20 percent for a three-year period. It also takes a determination by the purchasing office head to reduce those percentages in particular cases.

Sharing of collateral savings is limited to 10 percent of the projected savings, which it is estimated will accrue to the Government during an average or typical year's use of the item incorporating the change. However, when there are savings resulting from decreased use of government-furnished property, the contractor's share of the savings is the same as stipulated for instant contract savings.

Where a Program Requirements clause is involved, the contractor will be reimbursed for his cost of performance to the extent provided in the contract schedule. In addition, incentive sharings of cost reductions on the instant contract can be as much as 25 percent on fixed-price and incentive contracts and not over 10 percent on cost-plus-fixed-fee contracts. Sharings of future acquisition savings are limited to 10 percent to 20 percent on fixed-price and incentive contracts and 5 percent on cost-plus-fixed-fee contracts. Collateral savings can be shared in connection with a Program Requirement clause to the same extent as on the usual Value Engineering Incentive clause, *i.e.*, 10 percent of the savings based on an average or typical year's use of the item.

If your proposal involves a contract modification of more than $100,000, the certificate of current cost or pricing data required by law must be furnished.

The Defense Value Engineering Program's contractual requirements are set forth in the ASPR. I have described the most significant of these and recommend your reading them in full in the ASPR. These provisions are liberal in the sharing of savings with you. It will pay to study them in detail. Be alert for targets of opportunity to earn large value engineering dividends.

Aeronautical Systems Division

Weapon Systems for Tomorrow's Air Force

Major General Lee V. Gossick, USAF

Few elements of the Defense Department organization place such crucial dependence upon the nation's industrial community as does the Air Force Systems Command's Aeronautical Systems Division (ASD) in its day-to-day efforts to accomplish its military mission. Fundamentally, ASD is responsible for creating the aerospace weapon systems for tomorrow's Air Force. In pursuing this task, the division and its contractors address themselves to the whole range of conception, development, procurement and testing.

Within their purview are such diverse projects as aircraft, lubricants and survival equipment. To help meet the incredibly broad range of physical and intellectual problems in advancing the frontiers of technology, the division employs, or contracts for the services of, thousands of scholars, scientists, engineers, technicians, flyers, armorers, electronic and propulsion experts, as well as the management specialists needed to combine such seemingly unwieldy groups into purposeful and effective teams.

Currently, the division annually awards about 6,500 contracts to the aerospace industry—companies both large and small. These contracts total more than $6 billion, and represent more than half of the Air Force Systems Command's (AFSC) annual budget.

Headquartered at Wright-Patterson AFB, Ohio, ASD employs 6,600 people. Its facilities occupy some 2,500 acres and have a replacement value of $82 million. On the base there are, also, flight test facilities and six AFSC laboratories, covering the areas of aeromedicine, avionics, materials, flight dynamics, propulsion, and human resources.

What was to become the Aeronautical Systems Division began at Wright-Patterson AFB with the official creation of the U.S. Air Force in 1947. Soon thereafter, certain functions of the Air Materiel Command were assigned to the Air Research and Development Command and the Wright Air Development Center (later the Wright Air Development Division). Important additions and reorganizations during the next decade refined the structure to meet changing concepts of management and organization based upon the emerging weapon system concept.

In 1961, a major addition to AFSC's mission caused a large-scale change in the logistic and development functions of the Air Force. The former Air Materiel Command relinquished responsibility for the procurement of weapon systems, and became the Air Force Logistics Command. Simultaneously, the Air Research and Development Command assumed that responsibility and became the Air Force Systems Command. At Wright-Patterson, the amalgamation of procurement and development responsibilities led to the formation of the

Major General Lee V. Gossick, USAF, has been Commander, Aeronautical Systems Division, AFSC, since August 1969. He was assigned to ASD in 1967 first as Deputy for the F-111 Program and, in December 1968, became Vice Commander. From 1964 to 1967, General Gossick was Commander, Arnold Engineering Development Center, Tullahoma, Tenn. Prior to that he served in Headquarters, U. S. Air Force, where he held several positions in development and engineering areas. General Gossick holds B.S. and M.S. degrees in aeronautical engineering from Ohio State University.

AFSC Aeronautical Systems Division from the Wright Air Development Division.

Current Organization

Following World War II, the separate project offices, established to manage different aspects of a program, were unified into joint project offices to concentrate the managerial and engineering skills required for such complex programs as the B-52, the century-series fighters, and the X-15. By the early 1960s, these offices evolved into weapon system project offices; a few became full-fledged *system* program offices for directing work on systems such as the XB-70 and the X-20 aerospace vehicle.

At present the function of the division is divided among 14 deputies and additional directorates and system program offices (SPOs). These are the basic units of management in which all of the Air Force work on a particular weapon system is centralized.

The Development Planning Deputate is the heart and core of what is known as the "Advocacy Team" for aeronautical systems. They design the system; develop the rationale for its entry into the future force structure; make the initial cost estimate and demonstrate, through analysis and simulation, that the system will be effective in its projected employment and deployment in the anticipated threat environment.

SPOs often are formed as cadres within the Development Planning Deputate. Upon approval of the systems for acquisition or for contract definition, the SPO transfers to the Systems Management Deputate.

In certain instances, due to the size, priority and importance of a system, a SPO is established as a separate entity reporting directly to the Commander, Aeronautical Systems Division, or to the Commander, Air Force Systems Command.

The C-5 and F-111 are major programs on which the respective SPOs are presently reporting to ASD's commander. The F-15 program, on the other hand, is under direct management control of AFSC headquarters which has assumed functions and responsibilities, previously assigned to the program element monitor on the Air Staff of Headquarters, U.S. Air Force. At the same time, the F-15 system program director, who formerly reported to the Commander, ASD, now reports directly to the AFSC commander. Technical, engineering and staff support, however, still is provided by ASD.

The system program offices direct the development of the weapon system from its inception as a program to turnover to the operational command. This management responsibility includes all aspects of the program, from the training of personnel to the procurement of initial spare parts. They act as the Air Force control points for industrial and military relationships essential to the development of strategic and tactical systems. By fostering an atmosphere of initiative and creativity, the SPOs concentrate the broad general knowledge and the modern managerial competence essential to the development of future weapons.

The Deputy for Systems Management is responsible for directing and managing system acquisition programs. Just one of these, the Combat SPO, directs more than 20 different USAF weapon system programs and projects, mainly in support of operations in Southeast Asia. Within the Combat SPO, with its managers, specialists, buyers, and others, are five divisions whose efforts concentrate on such matters as guided bombs, missiles, and helicopters.

The Deputy for Subsystems Management contracts for more than $1.5 billion in goods, services and equipment each year. This activity alone now involves some 850 contractors with 2,400 active contracts, totaling more than $5 billion. Ground equipment, propulsion subsystems, jet fuel starters, ejection seats and life support equipment represent some of the specific items involved.

Most of AFSC's limited war and special air warfare programs, including appropriate aircraft, aerodynamic equipment and air mobility programs, come under the aegis of the ASD Tactical Warfare Deputate. However, some of the division's limited war efforts are also conducted by another of the elements, the Reconnaissance and Electronic Warfare Deputate. This office provides the coordination point for all aeronautical reconnaissance projects and manages procurement of photographic and electronic reconnaissance, mapping, charting and geodetic subsystems, as well as ground-based cameras, optics, mounts, illuminants and many other associated items including lasers, infrared and radar subsystems.

An ASD in-house systems engineering capability, unique in the Air Force, is provided by the Deputy for Engineering. This deputate provides a technical bridge between the laboratories and the program offices, assuring relevant and timely responses at all stages of system development. Staffed with highly qualified engineers and technical experts, the Engineering Deputate advises the entire division on development problems, beginning with the conceptual phases and continuing through in-service engineering. It also provides systems engineering services to other elements of AFSC and to other DOD agencies.

Criteria and Needs

In the next decade, the Air Force must have advanced weapon systems that will enable the nation to fight at any level of warfare. Options must be available to meet a wide range of contingencies: to retaliate if necessary; to deliver a first or second strike; and to reach all kinds of targets under extreme conditions of weather, terrain and hostile action. Intelligence collection and analysis, and command and control techniques, must be accurate and reliable to an exacting degree. Underlying all such considerations is the realization that specific requirements will change, that optimum weapon systems must be flexible, and that they must have the potential for growth. ASD has the obligation to meet these future needs.

Diversity for specific missions is mandatory. While aircraft and missiles must fly faster, farther and higher to meet certain mission requirements, it also is necessary for aircraft to fly low and slow and have the capability for long-loiter time in the target area for tactical exercises in support of ground forces. All must fly more accurately and be able to survive and penetrate potential defenses. In addition, the complete weapon

system must become operational within cost limits that are reasonable when measured against national needs. Although it is axiomatic that modern weaponry is increasingly complex, that very complexity must not reduce reliability, nor increase maintenance costs, nor waste valuable time, talent and supplies.

Originating New Weapons Systems

An important aspect of ASD's mission involves the origination of new weapon systems. To a notable extent, the impetus for such new systems stems from actual or predicted new threats to national security, or from changes in our own national political and military policies.

For example, several years ago, when a change in the world situation reduced the likelihood of nuclear warfare, the United States immediately needed a new capability for rapid, worldwide deployment of large forces. Furthermore, our national obligation to support collective security arrangements meant we would need to maintain large, expensive garrisons in many remote areas for indefinite lengths of time, *or* be able to get them there the moment trouble threatened. To help resolve this problem, ASD with the support of its industrial contractors began creating large, speedy long-range transports: complete systems capable of shifting troops rapidly to any troubled area and disengaging them after the threat had waned.

The result has been the C–141 and the C–5 transports, and the former has played an indispensable role in the Vietnam conflict. While the C–141 program for the most part has used technology completely tested and capable of immediate application, the C–5 has demanded new technical capabilities to overcome problems inherent in its size and propulsion needs. Nevertheless, the C–5 is already beginning to prove itself in test programs, having flown at a maximum gross weight of nearly 400 tons —more than twice that of the C–141.

So many different factors, ranging from cost and funding to the climate of international affairs, affect the creation of new aerospace systems, making predictions for the future risky. Nevertheless, industrial leaders need to know some of the likely directions which their work with ASD may take.

In the Future

One of the proposed systems which the division may procure in the future is the AX close-support fighter, involving subsonic designs. In December 1969 McDonnell Douglas Corp. was selected as the prime contractor for the F–15 tactical aircraft, an extremely fast, sophisticated, highly maneuverable air superiority fighter incorporating the latest avionics, fire control and propulsion systems. When the F–15 becomes operational, it must be able to counteract the most serious enemy threats envisioned for the mid-1970 period.

The whole vista of tactical missiles —air-to-air types for air superiority and air-to-surface missiles for close support and interdiction missions— are of constant concern to ASD.

Tactical electronic warfare systems are being studied comprehensively in order to identify practical and helpful concepts. The primary objective is to support aircraft attacking ground targets; but tactical electronic warfare also strives to defend that aircraft against attack, jamming radar, and analyzing enemy signals to determine the nature of the penetration environment.

Another area of marked interest is the design of support aircraft, such as the light intratheater transport (LIT), which may incorporate vertical or short takeoff and landing capabilities. Being sought is the type of aircraft that will facilitate the movement of troops and supplies into combat areas. Practical applications in the future should enable the Air Force to perform its logistic functions by flying directly into combat areas without preparing landing strips or pads, a capability that is particularly desirable in limited warfare situations.

ASD also plays a significant role in developing and maintaining strategic capabilities. Current emphasis on limited war has not deterred the division from proposing strategic aircraft to replace the reliable B–52. A current proposal is for an advanced manned strategic aircraft (AMSA), designated the B–1. In concept, the B–1, like the versatile B–52, could be applied not only in general war but also in certain limited war situations. It is an outgrowth of studies, conducted during the early 1960s, which identified a need for low-level penetration at supersonic speeds. Here again, advances in technology are required to achieve the necessary ranges, and to meet the required take-off and landing capabilities. Planners are drawing strongly on recent developments in avionics and propulsion subsystems, and materials and structural technology for the airframe and the variable sweep wings.

To make the strategic systems even more flexible, concepts of advanced tankers are currently under consideration. In the interim, the KC–135 tanker has been improved sufficiently for current needs, but the Air Force will require tankers with greater range and greater transfer capacities in the near future.

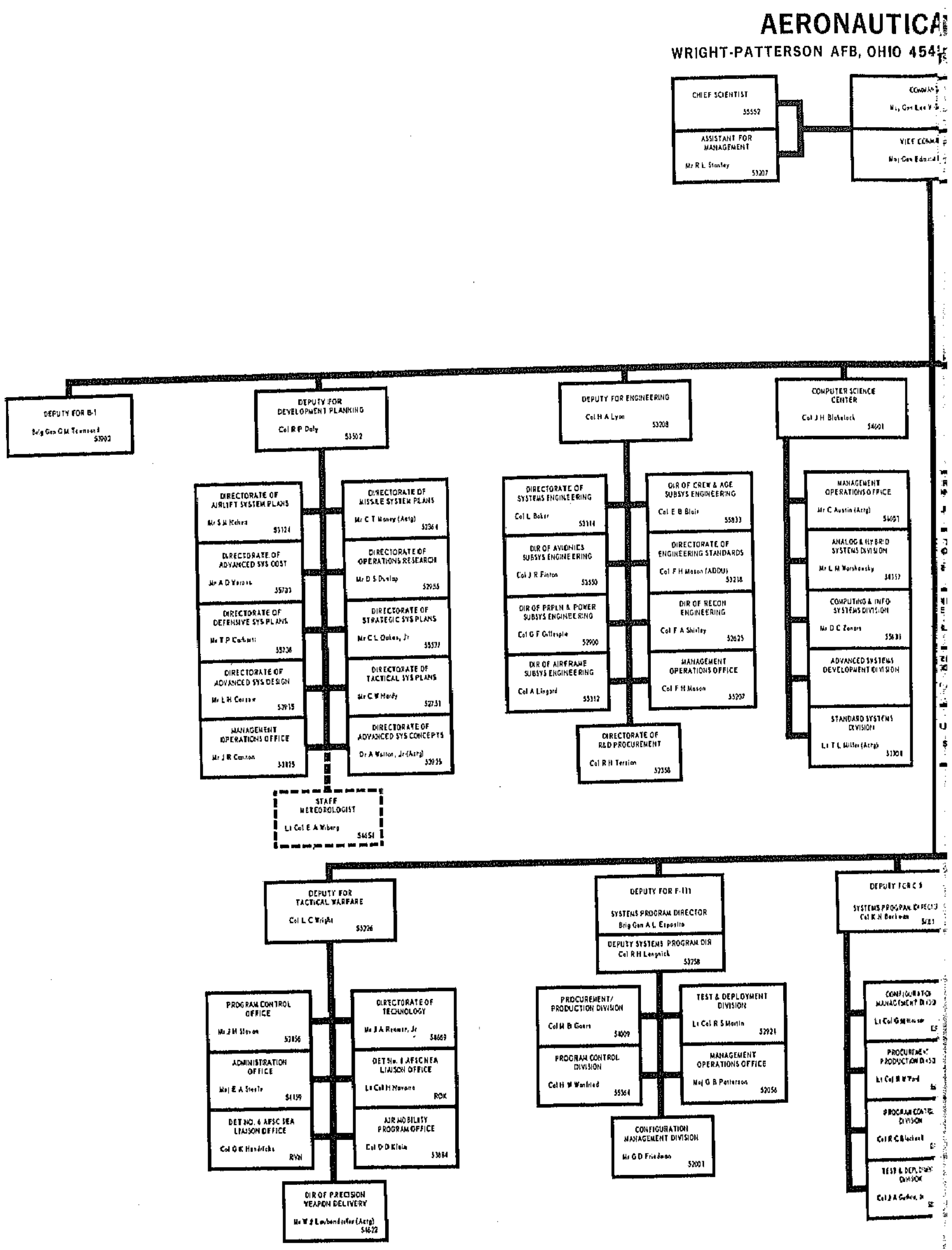
Development of the B–1 system, advanced tankers, new aerodynamic missiles and decoys, electronic aids for protection and penetration, and other related creations will provide the United States greater retaliatory and deterrent power for the 1970s. In an age of nuclear weaponry, aircraft continue to prove their effectiveness, in actual combat and in forcing present and potential adversaries to avoid rash actions in light of their probable consequences.

The Aeronautical Systems Division, with its extensive industrial support, seeks to apply imagination, planning and sound management to meet those goals that will assure the United States the air superiority essential to its security and its role in world affairs.

First Operational C–5 Delivered

The first operational C–5 aircraft was delivered to the Air Force Military Airlift Command on Dec. 17, 1969.

Four C–5s are being flight tested at Edwards AFB, Calif.; one at Pope AFB, N.C.; and three at the Lockheed-Georgia Co. plant.



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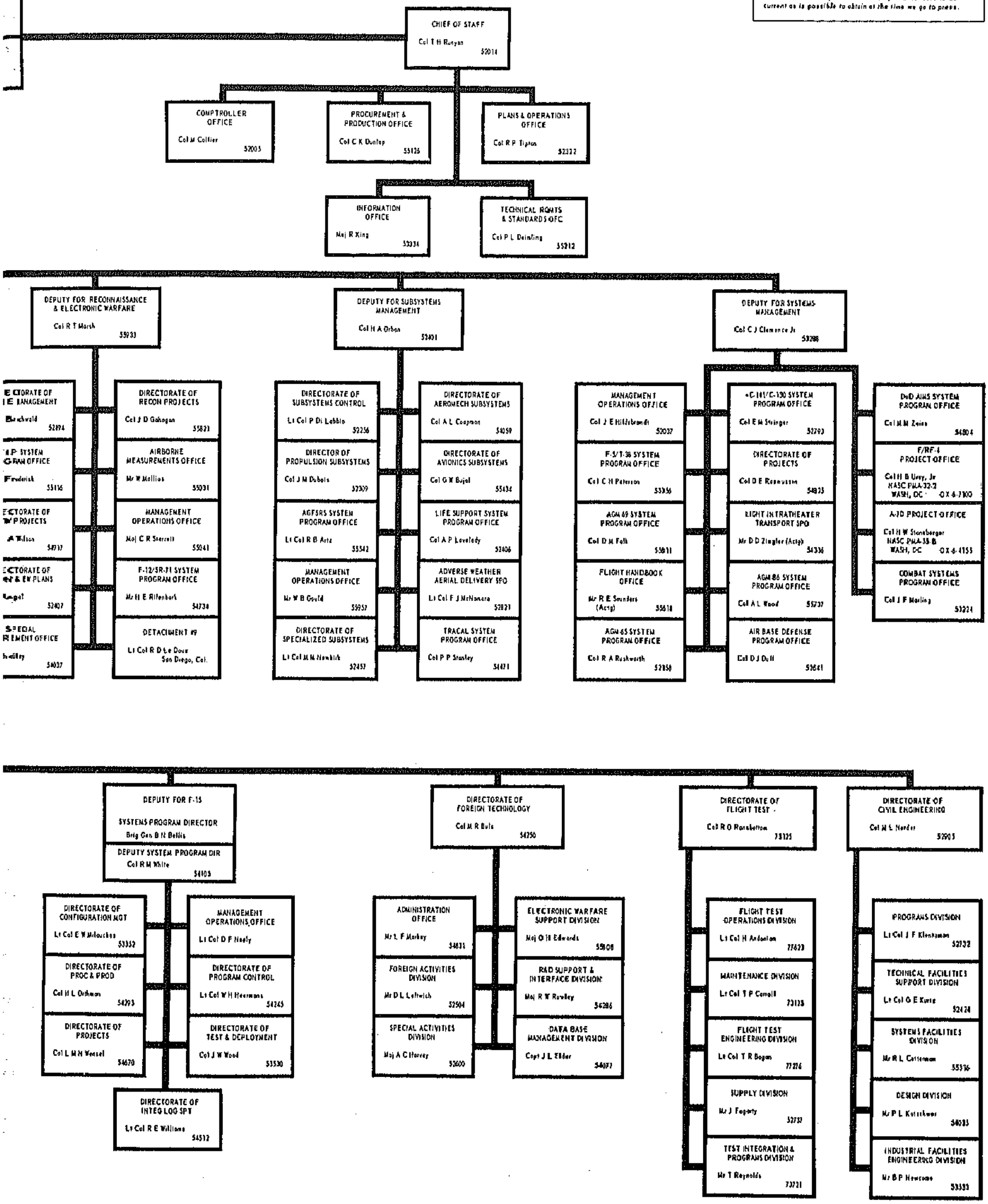
Editor's Note: Organization charts appearing in the Bulletin are edited by the editorial staff to reflect those elements of the various DoD organizations which are of interest to industry representatives. Organizational elements not involved in the DoD-industry relationship have been eliminated because of space limitation.

The information on personnel and telephone numbers is as current as is possible to obtain at the time we go to press.



ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Dr. Gardiner L. Tucker, who has been serving as Principal Dep. Dir., Defense Research and Engineering, has been appointed to the position of Asst. Secretary of Defense (Systems Analysis). He succeeds **Dr. Ivan Selin** who has been Acting Asst. Secretary for Systems Analysis and resigned at the end of January.

Richard G. Capen Jr., formerly the Principal Dep. Asst. Secretary of Defense (Public Affairs), has been appointed Asst. to the Secretary of Defense (Legislative Affairs). **Jerry W. Friedheim**, who has been Dep. Asst. Secretary of Defense (Public Affairs) since March 1969, has succeeded Mr. Capen as Principal Deputy.

Col. Elmer D. Howk, USAF, is the new Dep. Commander, Defense Logistics Services Center (Defense Supply Agency), Battle Creek, Mich.

DEPARTMENT OF THE ARMY

Robert L. Johnson has been appointed Asst. Secretary of the Army (Research & Development). Prior to his appointment, Mr. Johnson was vice president in charge of the Manned Orbiting Laboratory Program in the Missiles and Space Systems Division of McDonnell Douglas Corp. He has had 23 years experience as an industrial design engineer and executive. **Charles L. Poor**, who has been Acting Asst. Secretary, has returned to his responsibilities as Dep. Asst. Secretary of the Army (Research & Development).

Maj. Gen. Erwin M. Graham Jr., who has been Commander, Army Ammunition Procurement Supply Agency, Joliet, Ill., since June 1968, assumed command of the Army Munitions Command, Dover, N. J., on Feb. 1. He succeeded **Maj. Gen. Frank C. White** who retired from active service.

Brig. Gen. Frank A. Hinrichs has [illegible] ...nated Dir., Procurement ...n, Hq., Army Materiel [illegible] succeeds **Brig. Gen. Michael E. Leeper** who has become the command's Dir., International Logistics.

Brig. Gen. Ross R. Condit Jr. has been assigned as Commander of the Combat Service Support Group, Army Combat Developments Command, located at Ft. Lee, Va.; and **Col. George E. Wear** is the new commander of the Combat Developments Command's Infantry Agency.

The former Chief of the Microbiology Div., Natick (Mass.) Laboratories, **Dr. Hamed M. El-Bisi**, has moved to Headquarters, Army Material Command, as Chief, Science and Technology Div., Directorate of Development and Engineering.

Brig. Gen. Spurgeon H. Neel Jr. is now Dep. Surgeon General of the Army.

Col. Robert M. Pearce is now Dep. Commander for Land Combat Systems, Army Missile Command, Redstone Arsenal, Ala. He succeeds **Col. Cyril D. Sterner** who retired.

Col. William D. Canfield is the new commander of the Army Communications Systems Agency, Ft. Monmouth, N. J.; and **Col. John W. Oliver**, USAF, has been assigned as Chief of the Defense Communications Agency's Satellite Communications Field Office, collocated with the Army Satellite Communications Agency at Ft. Monmouth.

New assignments announced by the Corps of Engineers are: **Col. Richard F. McAdoo**, Executive to the Chief of Engineers; and **Col. James E. Bunch**, District Engineer, Rock Island, Ill.

DEPARTMENT OF THE NAVY

RAdm. John E. Dacey, formerly Anti-Ship Missile Defense Program Coordinator in the Office of the Chief of Naval Operations, has been designated Asst. Dep. Chief of Naval Operations (Fleet Operations and Readiness).

RAdm. Harvey P. Lanham has been assigned to the position of Dir., Logistic Plans Div., Office of the Chief of Naval Operations.

Capt. George L. Dickey Jr. has been named Navy Dep. to the Dir., Advanced Ballistic Reentry Systems Program, Ballistic Systems Div., Norton AFB, Calif.

New Dep. Commander, Atlantic Div., Naval Facilities Engineering Command, Norfolk ,Va., is **Capt. John F. Beaver**.

Capt. Kenneth E. Wilson Jr. assumed command of the Pearl Harbor Naval Shipyard on Jan. 30.

DEPARTMENT OF THE AIR FORCE

The Air Force has announced the retirement of the following general officers: **Lt. Gen Arthur C. Agan**, Commander, Aerospace Defense Command, Ent AFB, Colo., effective March 1; **Lt. Gen. Benjamin O. Davis Jr.**, Dep. Commander in Chief, U. S. Strike Command, and additional duty as Dep. U. S. Commander in Chief, Middle East, Southern Asia, and Africa South of the Sahara, MacDill AFB, Fla., effective Feb. 1; **Lt. Gen. Robert J. Friedman**, Vice Commander, Air Force Logistics Command, Wright-Patterson AFB, Ohio, effective Feb. 1; **Lt. Gen. James W. Wilson**, Vice Commander, Military Airlift Command, effective Feb. 1; and **Brig. Gen. John French**, Dep. Chief of Staff, Comptroller, Air Force Logistics Command, Wright-Patterson AFB, Ohio, effective Feb. 1. Replacements for these positions had not been announced at press time.

Jack L. Stempler, who has been Asst. to the Secretary of Defense (Legislative Affairs), has moved to the Department of the Air Force as General Counsel. He succeeds **John M. Steadman** who resigned.

Brig. Gen. Otis E. Winn, formerly Asst. to Dir. of Transportation, Office of Dep. Chief of Staff, Systems and Logistics, Hq., USAF, is now Dep. Commander for Resources and Management, Military Traffic Management and Terminal Services, Washington, D. C.

Industry Disaster Preparedness

John E. Davis

National preparedness for defense used to mean that America could preserve the peace or wage war successfully by maintaining a small military force and an industrial capability that could expand to meet the demands of war. In two world wars, this kind of preparedness did the job it was supposed to do because the U.S. mainland never was attacked and we had time to expand our military forces and our industrial capabilities. However, we no longer can be certain that the home front will not be a combat area at the beginning of a nuclear war. In the age of the nuclear warhead and the intercontinental ballistic missile, industry must be able to survive under direct attack and to resume the industrial processes that will put the nation on the road to recovery. In short, industry needs civil defense preparedness.

The dimensions of the nuclear threat—and the need for a national civil defense effort—are familiar to most managers of our defense industries. Although all of us concerned with the nation's defense must be encouraged by the strategic arms limitations talks (SALT), which are under way with the Soviet Union, some grimmer facts of international life persist and promise to be with us for sometime to come.

Thousands of nuclear weapons deployed throughout the world raise, if nothing else, the prospect of an accident or an accidental nuclear exchange. Red China is making a strenuous effort to become a major nuclear power. The technology of nuclear weapons continues to proliferate, and an epic technological struggle continues in the search for an ultimate weapon or defense system.

In this kind of world, civil defense is a major element in the national defense structure of the United States and of other major nations as well. The Soviet Union, for example, takes civil defense seriously. Civil defense training and education has been made mandatory at the secondary level in Soviet schools, and Soviet industry is assigned a large role in civil defense education and emergency operations.

The U.S. civil defense program has an extensive and complex mission laid down by Congress in the Federal Civil Defense Act of 1950. It embraces programs to educate and inform the individual citizen on the nuclear threat, and to provide him with fallout protection through a system of public shelters and home preparations. Other civil defense programs aim at every element of our society—governments at every level, school systems, agriculture and industry. The goal is to have our political, economic and social institutions build up a capability to survive a nuclear war.

Preparedness for nuclear disaster has an important corollary: it pays off in better capability to meet serious peacetime emergencies. Civil defense personnel, equipment and communications see frequent peacetime service in tornadoes, hurricanes, forest fires and floods, and in man-caused emergencies, including industrial accidents.

John E. Davis is Director of Civil Defense and head of the Office of Civil Defense in the Office of the Secretary of the Army, Washington, D. C. Before assuming this position in May 1969, Mr. Davis served two terms as Governor of North Dakota from 1956 to 1960, and was National Commander of The American Legion from 1966 to 1967. He is a graduate of the University of North Dakota with a degree in business administration.

Cooperation Necessary

Working with industry on the problem of survival in nuclear war is a major element of the Office of Civil Defense program, because close cooperation between industry and Government at all levels is essential to effective civil defense. Two reasons for this are immediately obvious.

The daily lives of 85 million Americans are bound up with their jobs in industry and business, where they are available for and receptive to training and education in civil defense protection measures. An essential civil defense objective can be attained if industry, in its normal training and education programs for safety and security, includes information bearing on nuclear war hazards and protective measures against them.

A second obvious reason for industrial civil defense preparedness is the fact that industry and business must now take steps, not simply to expand production, but steps to protect its management structure, work force and production processes against the effects of a nuclear attack.

A Company Plan

Emergency planning against nuclear attack is becoming standard practice in American industry.

A major oil company states its policy on emergency planning in this fashion: "The purpose of this Emergency Plan is to insure that reasonable measures are taken to provide for continuity of management, protection of personnel, safeguarding of property and the restoration of operations and services to enable the company to supply products, to meet military and civilian requirements in the event of enemy nuclear attack in order to assist the nation to survive, recover and win." Going further, this same company told a congressional committee that "It is the company's policy to cooperate fully with governmental authorities in implementing an effective program to provide for the safety of our citizens in the event of nuclear attack."

The starting point for industrial [illegible] [illegible]nse is a company plan set- [illegible] measures for preserving [illegible]ate structure and decision-making capability, protecting vital financial and production records and protecting its employees.

A typical company plan will contain provision for management succession—documents or organization chart which names alternates for management positions in the company to replace casualties, or those who are unable to reach an operations site.

An alternate company headquarters may be designated to house operations if the permanent headquarters is damaged or destroyed. Many large companies have established emergency headquarters with skeleton staffs, extensive communications capabilities, and provisions for "buttoned-up" operations under fallout conditions.

Alternate company headquarters may be the repository for duplicate sets of vital company records. An interesting offshoot of industrial records protection efforts are business enterprises which have built protected storage sites, and offer industry a duplication and storage service for vital company documents.

The shutdown procedures and other safety and security measures for peacetime emergencies may serve, with little adjustment, in a nuclear emergency plan to protect company property and equipment.

Employee Protection

The protection of employees against attack effects is the paramount step for civil defense preparedness.

When the company or business faces the problem of employee protection, it moves to the core of the national civil defense effort. Above all other considerations, the job of civil defense is to save lives. It is our only strategic defense program which is directly concerned with saving civilian lives. Defense Department studies show that the national shelter program, alone, would be responsible for saving millions of lives under conditions of nuclear attack. President Nixon has expressed his concern about the protection of our population in nuclear war, and has ordered a special study of the life-saving capabilities of a national shelter system.

The greatest benefit to the civil defense program results when industrial security personnel, as well as local civil defense officials, work together for the protection of people against nuclear attack.

Local Director's Tasks

The local director, if he participates in the Federal civil defense program (and more than 4,000 local jurisdictions do) has three major tasks:

- Establish a local system of public shelters.
- Create the organizational capability to coordinate rapidly the disaster-control efforts by all units in or readily available to local government.
- Educate and inform the citizens of his community on what to do and where to go to survive nuclear attack.

The basis for cooperation between industry and local civil defense on shelter is clear: a community shelter system means that employees of industry have fallout protection, with shelters provisioned with food, medical supplies and radiation protection equipment through Federal grants of shelter supplies to the nation's communities. Industry, on the other hand, can provide shelter in its physical plant because the heavily built structures of industry, almost invariably, have inherent shelter capability.

Industry has skilled volunteers in almost every field who can strengthen a local government civil defense staff, when it must be expanded for emergencies. Industrial safety personnel, trained in disaster control, have skills that civil defense operations demand. Workers with first aid training have a valuable civil defense skill. Civil defense officers also make available to industry medical self-help training, going beyond normal first aid to serve in situations where professional medical help may be unavailable for a considerable period of time. This situation could be commonplace in a population in shelter.

The public information and education mission laid down by the basic Federal civil defense law is probably the most formidable task facing civil defense. Survival instructions and information must compete for public attention with myriads of messages bearing more pleasant news, yet it

must have significant impact and retention value for an entire population.

Industry has helped civil defense with this task in an outstanding manner. Civil defense publications have been distributed through industry's channels for informing its workers on safety and security. Industry has released its employees for civil defense training and education and has provided classroom space in its facilities. Management has motivated its employees to train for service in an emergency as shelter managers or radiological detection specialists. This is a field in which industry serves community interests as well as its own. Most, if not all communities, may need volunteers from local industry for these civil defense tasks.

Natural Disasters

The dual aspect of civil defense—the peacetime benefits that are gained from nuclear attack preparedness—should be self-evident. Every day, across the nation, local governments draw on personnel trained in civil defense and equipment and communications intended for nuclear emergency, to cope with a peacetime natural disaster or a man-caused catastrophe, such as an industrial accident. These occurrences frequently see industrial safety personnel and civil defense cooperating to contain disaster and save lives.

The destruction wrought by Hurricane Camille is still fresh in the minds of most Americans. Through civil defense preparedness, the toll of lives taken by that vicious storm was held to hundreds instead of thousands. Through industry and civil defense cooperation, and the cooperation of many other elements of government and the private sector, relief and recovery operations were given added impetus and speed.

Even more recently, civil defense facilities and personnel got a peacetime workout from the massive blizzard which hit New England during Christmas week 1969. State and local civil operating centers provided emergency communications and coordinated the efforts of relief agencies around the clock. These civil defense facilities were also centers for the release of press and public information bulletins.

When power lines were downed by the storm, civil defense emergency generators provided heat and power to nursing homes, hospitals and public shelters.

Storm conditions in New England were reported continuously to the Office of Civil Defense and the Army Operations Center in the Pentagon.

Preparedness Tested

Industrial safety engineers will recall the August 1965 explosion at Rubbertown, the huge industrial complex on the outskirts of Louisville, Ky. The disaster took 13 lives but disaster fighters—from both industry and government—contained the threat of secondary explosions, cooperated to evacuate the residents of several hundred homes near the explosion site, and set up the communications and command posts for the direction of operations. A factor contributing to the efficiency of the operation was a civil defense training exercise, involving industry and the Louisville-Jefferson County civil defense organization, which took place early in that year and set up conditions identical to those of the morning of August 26 when actual disaster struck. Communications, hospitals, alerting systems and governmental authority had all received a working test of readiness for an actual emergency. On a smaller scale, industry civil defense cooperation of this kind is almost a daily occurrence.

The Office of Civil Defense and the civil defense program exist to plan, organize, coordinate and finance civil government operations that contribute to attack preparedness. Government cannot cope with a nuclear emergency or natural disaster alone. The nation needs informed action by every citizen and every organized group to assure survival and recovery in nuclear war. Nuclear attack preparedness, in government, in industry, in school systems, and in the home provides people with life-saving information, and creates organizational skills for coping with emergencies and saving lives every day. This aspect of the national civil defense effort gives immediacy and even urgency to more widespread civil defense preparedness in industry and business.

SECURE CORPORATE ARCHIVES. In a former Pennsylvania limestone mine, 205 feet underground, Westinghouse Electric Corp. operates a records storage center.

Photo courtesy Westinghouse Electric Corp., Pittsburgh, Pa.

ASPR Committee Case Listing

The following is a listing (revised as of Dec. 8, 1969) of the cases currently under consideration by the Armed Services Procurement Regulation (ASPR) Committee, of the Office of the Assistant Secretary of Defense (Installations and Logistics).

On items marked by asterisks, the text has been omitted to shorten the listing. The asterisks denote actions taken as shown below:
**—Case closed, no ASPR revisions resulting.*
***—Case closed, approved for printing in a subsequent ASPR revision.*
****—Case closed, approved for printing subject to further government coordination.*

The listing includes subjects of interest to contractors but excludes cases of a minor or editorial nature, those considered "sensitive," and those involving a deviation from the regulation which are processed by the ASPR Committee.

The ASPR Committee meets with representatives of major industry associations periodically to explain the purpose and status of each of the cases under consideration, and to answer questions from industry representatives concerning the cases. All proposed ASPR changes of major policy are forwarded to industry associations in draft form for the review and comments of the association memberships. Industry comments are evaluated by the Defense Department before a final decison on the proposal is made by the ASPR Committee.

**Review of the Implementation of Public Law 87-653.

* Cost Information Reports(CIR).

** Rental Cost—ASPR 15-205.34.

Communications Services. Development of uniform ASPR coverage which would permit deletion of existing departmental coverage with respect to procurement of communication services from both regulated and unregulated suppliers. Industry comments have been received, considered, and revised coverage developed. Comments from the Office of the Director, Telecommunications Management, and the Federal Communications Commission have been received and are under consideration.

Advance Understandings of Allowability, ASPR 15-107. To revise the existing ASPR paragraph to explicitly provide that such agreements must be in writing to be binding on the Government. Proposed ASPR coverage concerning Advance Understandings on Particular Cost Items was forwarded to industry for comment on May 29, 1968. Final action on this case had been deferred pending completion of the committee's consideration of the ASPR Corporate Administrative Contracting Officer Program case.

** Technical Data Warranty Clause.

Revisions to ASPR 15-205, Cost Principles on Bid and Proposal and Independent Research and Development. The proposed revisions to the existing ASPR cost principles on Independent Research and Development and Bid and Proposals were developed as a staff action outside of the ASPR Committee and referred to the committee for editing and the obtaining of industry comments. This material was forwarded to industry on Jan. 29, 1968. On March 25, 1968, the reporting date for submission of comments by industry and government agencies was extended to June 30, 1968. Industry comments have been received. The subject case is still under study.

Clauses for Service Contracts. To develop a new Part for ASPR Section VII to cover service contracts generally, incorporating by reference, to the extent feasible, the fixed-price and cost-reimbursement clauses contained in Parts 1 and 2 of Section VII. This matter is still under development.

** First Article Approval.

* Revision of the CWAS Coverage.

Proposed ASPR 9-203(f) Clause, Rights in Technical Data—For RDT&E and Acquisition Contracts for Major Systems and Subsystems. To consider modifying the ASPR policy concerning rights in technical data insofar as research, development, test and evaluation (RDT&E) and acquisition contracts for major systems and subsystems are concerned, by prescribing a special clause for inclusion in prime major systems and prime subsystems RDT&E contracts which would require the contractor to permit subcontractors to sell subcontractor-fabricated parts or services directly to the Government without the payment of license fees or other inhibition, notwithstanding that such subcontractor effort may require the use of limited rights data furnished by the prime contractor. Consideration of the coverage in this area was delayed awaiting receipt of comments from CODSIA. This matter is now under consideration by higher authority.

Mandatory Application of ASPR Cost Principles in Fixed-Price Contracts. To develop a revision of ASPR Section XV to make use of the cost principles set forth in Parts 2, 3 and 4 mandatory in fixed-price contracts whenever costs are relevant in the pricing of fixed-price contracts. A draft of the proposed coverage to accomplish the foregoing was forwarded to industry for comment on May 14, 1969. Industry comments have been received and considered. This matter is now under consideration by higher authority.

* Title and Risk of Loss Clause—ASPR 7-103.6—Applicability to Cost Reimbursement Type Contracts.

** Definitization Clause for Letter Contracts.

** ASPR 14-406, Nonconforming Supplies and Services.

** Amendment of Certain ASPR Provisions Relating to Patents and Data.

Delinquent Delivery Schedules on Other Than Cost-Reimbursement Type Supply and Service Contracts. To modify various provisions of Section VIII, Part 6, to clarify the rights and obligations of both parties in the

event of delinquent performance. The proposed revisions were forwarded to industry for comment on March 3, 1969. Industry comments have been received. This matter is still under consideration.

** **Review of Bid Protest Regulations.**

** **Proposed Revision to ASPR 15-203 Regarding Off-Site Burden Rates.**

** **Application of Burden to Settlement Expenses and Settlements With Subcontractors.**

** **Accounting and Control for Government-Owned Property.**

Transfer of Materials between Contracts. This case addresses itself to a proposal to permit easier transfer of material between contracts, and to permit retention by contractors of excess, contractor-acquired, government-owned material at the lesser of cost or market, and was submitted to the industry associations on Feb. 13, 1969, for comment. Comments have been received. This matter is still being considered.

** **CODSIA Termination Recommendations.**

Termination—Deferring Determination Whether for Default or Convenience Clause. To consider whether an ASPR clause embodying the subject concept should be developed for inclusion in the regulation. Such a clause, half-way between the present ASPR Default clause and the present ASPR Termination for Convenience of the Government clause would permit termination of a contract while deferring the contracting officer's decision as to whether (a) the contract is in default; or (b) termination should be for convenience of the Government. To also consider whether the Stop Work Order clause should be modified to authorize conversion of a stop work order to a termination for default as well as a termination for convenience as is now provided. This item was forwarded to industry for comment on July 18, 1969. The date for receipt of comments was extended to October 6. Industry and government comments are being considered.

** **Guidelines for Administration of Small Business/Labor Surplus Area Subcontracting Programs Clauses.**

* **Foreign Tax Clause, ASPR 11-403.**

Conflict of Interest Clause. To consider whether further guidance in the regulation and appropriate contractual safeguards should be provided to avoid conflicts of interest which may be occasioned by acquisitions and mergers involving systems engineering contracts. This item was forwarded to industry for comment on July 8, 1969. Comments have been received and are currently under study.

ASPR Section IX, Part 2. To consider whether amendments to Section IX, Part 2, and other pertinent ASPR sections are necessary in view of the re-issued DOD Instruction 5010.12, dated Dec. 5, 1968, entitled "Management of Technical Data." This case is still under study by a subcommittee.

* **Use of Firm Fixed-Price Contracts for Development.**

Construction Warranty Clause, ASPR 1-324.10. To develop a revision of the subject clause in light of comments of the Association of General Contractors covering (a) design; (b) damages from defects and failures; and (c) use of the term "agent." This item was forwarded to industry for comment on Aug. 7, 1969. Receipt of comments from industry was extended to October 28. Comments have been received and are under consideration.

* **Specially Rated DOD Insurance Plans; (A) DOD Term Insurance Plan and (B) The National Defense Project Rating Plan.**

* **Recommended Changes to (A) Group Insurance Plans Under Cost-Reimbursement Type Contracts, ASPR 10-505, and (B) "Insurance-Liability to Third Persons" Clause, ASPR 7-203.22.**

Location Allowances at Unfavorable Locations. To consider the desirability of removing the current language in ASPR 12-105 and 15-205.6(j) on the basis that the existing coverage is no longer necessary, does not serve a useful purpose and, thus, should be eliminated. In conjunction with this action, to consider the desirability of modifying 15-107(i) to add coverage with respect to allowances for off-site pay, incentive pay, location allowances, hardship pay, cost-of-living differential, and the like. This item was forwarded to industry for comment on Aug. 7, 1969. Industry and government agency comments have been received, and are under consideration.

Verification of Catalog or Market Price Exceptions under Public Law 87-653. To consider the recommendation of the General Accounting Office that ASPR be revised (a) to require contractors to submit sales data of recent commercial sales for approximately similar quantities of the proposed purchase by the Government, prior to acceptance by the Government of a catalog or market price, and (b) to further provide that contracting officers to be required to verify the sales data submitted by contractors. The proposed coverage and a new DD Form 633 were forwarded to industry for comment on Sept. 29, 1969. The date for submission of comment was extended to Dec. 15, 1969.

Health and Safety Clauses. To review and present recommended changes concerning the applicability of the Health and Safety clauses currently prescribed in ASPR 7-104.78, .79, and .80, in light of the comments on this matter received from CODSIA. Revised ASPR coverage was forwarded to industry on Sept. 2, 1969. Comments have been received and are under consideration.

* **Government Property Clauses.**

Revision of ASPR B-311, C-311 and S3-603. To make necessary revisions to Appendix B-311 and Appendix C-311 and Supplement 3 to provide for uniform reporting by contractors of government property. Revisions to DD Form 1662 are included in the case and the subcommittee report has been extended until mid-December.

Financial Accounting for Government-Owned Facilities. Studies are underway to determine the extent of financial accounting required to effectively control government-owned facilities. This matter is still under consideration.

Single Service Management of Industrial Facilities. To develop procedures which will provide that only one contract authorizing use of government facilities will be in effect at any one location. It is intended that contracts which authorize the acquisition or furnishing of government facilities will provide for the automatic transfer of those facilities to the

"use" contract upon receipt of installation. The subcommittee reporting date has been extended to Feb. 28, 1970.

Corporate Administrative Contract Officer Program. To provide for the appointment of a single corporate administrative contract officer to act, in the case of multi-plant companies, on matters which have corporate-wide application. The corporate administrative contract officer will not act on matters having only local application. These matters will continue to be received by the plant administrative contract officer. This matter is now under consideration by higher authority.

Bailment of Government Property to Contractors. To consider the development of proposed ASPR coverage including definition and policy with respect to bailment of government property to a contractor, as well as to the development and publication of a standard ASPR format of bailment agreement for DOD-wide use.

ASPR 15-205.6(f), Deferred Compensation. To clarify ASPR 15-205.6(f) covering deferred compensation in light of the questions raised concerning: (a) whether deductibility for Federal income tax purposes is a prerequisite to allowability for contract cost purposes; (b) the extent to which acturial gains and losses (including unrealized market appreciation and depreciation) must be taken into account in determining costs; (c) whether the cost of improvements in benefits to retired employees are allowable; (d) whether pay-as-you-go pension payments are allowable; and (e) whether contributions of interest equivalents or unfunded pension liabilities are allowable. This item was forwarded to industry for comment on July 8, 1969. Industry and government agency comments have been received and are under consideration.

"Limitation of Costs" ASPR 7-203.3, "Limitation of Funds" ASPR 7-402.2. To consider suggested changes of the subject clauses presented in a letter from Aerospace Industries Association, dated March 12, 1968, together with numerous other changes relating to procedural guidance and other miscellaneous areas of the regulation set forth in the letter. In considering the proposed change to the Limitation of Costs, Limitation of Funds clauses, the committee, rather than make changes in these clauses, developed a Special Termination clause for use in incrementally funded cost-reimbursement or fixed-price incentive contracts with a period of performance of two or more years, an estimated expenditure in excess of either $25 million of research, development, test and evaluation funds or $100 million of production funds. Under the clause, the contractor and the Government would reach agreement on maximum costs for certain categories of termination. These costs would then be excepted from the fund restrictions of the Limitation of Costs or Limitation of Funds provisions. The Special Termination Costs clause was forwarded to industry for comment on July 18, 1969. Comments have been received and are under study, as are the remaining recommendations and suggestions set forth in the Aerospace Industries Association letter.

ASPR Coverage for Training and Educational Costs. To consider the necessity for revising ASPR 15-205.44 in light of internal and external correspondence indicating (a) the need for supplemental guidance to cover cost of attendance of contractor employees at specialized courses, such as those conducted by the Harvard Graduate School of Business Administration; (b) to allow part-time education related to "company areas of interest in the field where the employee is now working or may reasonably be expected to be employed;" (c) liberalization of the 156-hours-per-year limitation on part-time education; (d) relaxation of the one-year limitation for full-time graduate or post-graduate study and allowing education for other than engineering and scientific purposes; (e) allowing "matching payments"; and (f) to consider the feasibility of allowing all reasonable training and educational costs. A report from the subcommittee on this subject is in and scheduled to be considered in the near future.

Forward Pricing Rate Agreements. To consider the desirability of providing ASPR coverage with respect to forward pricing rate agreements covering (a) definition; (b) establishment; (c) use; and (d) procedures, as well as the relationship of such agreements to contracts subject to the requirement of Public Law 87-653. Proposed coverage has been developed and was forwarded to industry for comment on Oct. 30, 1969.

Clarification of Application of CWAS to Limitations Contained in the Cost Principles. To consider the need of clarifying the application of CWAS to specified restrictions or exclusions contained in the cost principles, as well as the correction of any errors in the CWAS designations. The proposed revisions were forwarded to industry for comment on Nov. 18, 1969.

Warranties—Consequential Damages. To develop DOD policy and appropriate ASPR coverage for contractual warranties, expressed and implied, relating to latent and patent defects, as well as consequential damages. This assignment involves not only consideration of the expressed or implied warranties under the Inspection clause, but further includes consideration of whether specific contractual provisions should be developed to cover these areas. This matter is still under consideration.

Severance Pay to Employees on Support Service Contracts. To consider whether ASPR 15-107, "Advance Understandings on Particular Cost Items," should be expanded to explicitly cover severance pay when support service contracts are replaced, particularly with respect to payment to employees whose employment with the phasing-out contractor is severed but who maintain continuity of employment and credit for seniority with the follow-on contractor. Additional clarifying language has been developed by the committee and concurred in for the purpose of obtaining industry comments.

Negotiated Overhead Rates Clause. To consider revising ASPR Section III, Part 7, to eliminate the duplication of effort and the excessive administrative burden generated by paragraph (d) of the Negotiated Overhead Rates clause, which requires the modification of each affected contract to incorporate annually negotiated overhead rates. Proposed coverage providing that written overhead agree-

ments, executed by both the Government and the contractor, will be automatically incorporated upon execution into all affected contracts has been developed. The proposed coverage was forwarded to industry for comment on Nov. 18, 1969.

Late Proposals and Modifications in Negotiated Procurements. To consider revising ASPR 3-506 covering late proposals and modifications thereof in negotiated procurements in light of the numerous General Accounting Office decisions in this area.

Omnibus General Accounting Office and DOD Audit Clauses. To consider the feasibility of developing an omnibus General Accounting Office Examination of Records clause and an omnibus DOD Audit clause to replace the existing Examination of Records clauses and the numerous DOD Audit clauses. The development of a single Examination of Records clause has been undertaken in conjunction with representatives of the General Accounting Office. Similarly, a draft of a proposed single DOD Audit clause has been developed. It is contemplated that the new clauses will be forwarded to industry for comment in the near future.

Evaluation Criteria. To undertake the development of additional guidance of evaluation criteria to be included in solicitations, thus giving effect to numerous General Accounting Office decisions that prospective offerors should be advised of the relative importance to be attached to each evaluation factor. This matter is presently under study.

Nike Hercules Sites Closing

Further reduction in Nike Hercules units has been announced by the Army, to be completed by March 31, 1970. Previously announced Nike Hercules inactivations, scheduled for completion by June 1970, have been revised and will also be completed by March 31.

The recently announced actions will close six firing sites and four headquarters sites in the Niagara-Buffalo and the Cincinnati-Dayton areas. Four Nike Hercules batteries and one headquarters and headquarters battery will be closed at Fort Bliss, Tex.

NAVSUP Observes 175th Anniversary

The U.S. Navy Supply Corps will observe 175 years of "service to the Fleet" on Feb. 23, 1970. Now known as the Naval Supply Systems Command (NAVSUP), one of the systems commands of the Naval Material Command, it manages a worldwide logistic network supporting the Fleet in peace and war.

In 1795, Congress established a Purveyor of Public Supplies, thus instituting Navy Procurement and Supply Ashore. The Navy Supply Corps grew in status in succeeding years and, in a Navy reorganization in 1842, a Bureau of Provisions and Clothing was established, succeeded in 1892 by the Bureau of Supplies and Accounts. In 1966, when four bureaus of the Navy Department were reorganized into six systems commands, it became the Naval Supply Systems Command under the Chief of Naval Material.

NAVSUP's mission consists of six responsibilities: supply operations, purchase, resale, food service, printing and transportation. It exercises management control over three inventory control points and nine U.S.-based naval supply centers and depots. At these installations, determination is made on what and how much to buy, when to buy it, and where to store it. NAVSUP does not buy the Navy's ships, planes and missile systems, but it does buy the repair parts, components and assemblies that keep the ships and weapons operating—from bullets and bombs to shipboard winches, anchors and overhaul services.

The command operates the Navy resale system through which it supplies the Navy exchanges, commissary stores, ships stores afloat, and Military Sea Transportation Service exchanges. Total sales in these activities amounted to $1.08 billion in FY 1969.

In its other areas of responsibility, NAVSUP operates the Navy food service program, including menu planning and food preparation, research on food handling, new techniques and equipment, and supervision of food management operation in the field. The command manages the Navy Publications and Printing Service, involving printing of all publications distributed to ships and stations—from ships' logs to official stationery. NAVSUP determines the Navy's requirements for transportation of materiel, provides funds for transportation costs, and monitors carriers' performance.

Marine Corps To Get British Harrier in 1971

Negotiations have been completed with the British government to purchase 12 Harrier aircraft for the U.S. Marine Corps. The Hawker-Siddeley Harrier is an operational single-seat, single-fanjet, transonic light attack aircraft, powered by a Rolls Royce Bristol Pegasus engine with a verticle/short take-off and landing (V/STOL) capability.

Currently, the Harrier is the only operational jet V/STOL in the free world. Introduced into military service by the British Royal Air Force in April 1969, Harrier represents the culmination of 10 years research and development in V/STOL technology by the British government.

Deliveries of the aircraft to the Marine Corps will begin in January 1971.

Bullet Proof Tire Developed by USAF

A puncture proof tire has been developed for the Air Force by the Aeronautical Systems Division (ASD), AFSC, Wright-Patterson AFB, Ohio.

Produced by the Goodyear Tire and Rubber Co., Akron, Ohio, the tire is filled with a special foam rubber of controllable density. Pressures can be produced in 5-pound increments, from 10 to 100 pounds, to simulate that of pneumatic tires.

Tests have indicated that punctures with sticks, glass, nails, sharp spikes, bullets and like materials produce no deterioration in performance. In endurance tests, the tires have shown 25-percent greater life than pneumatic tires of comparable size and capacity.

Project engineer is William Gregory of the Vehicle and Maintenance Branch of ASD.

Status of Funds Quarterly Report

Outlays

First Quarter, Fiscal Year 1970

(Thousands of Dollars)

Department of Defense	Outlays: July 1969	Outlays: August 1969	Outlays: September 1969	Outlays: Cum thru 30 Sept 1969	Unpaid obligations: At start of year	Unpaid obligations: As of 30 Sept 1969
Military Personnel						
Active forces	1,633,174	1,818,588	1,838,604	5,290,366	592,306	849,157
Reserve forces	103,937	125,772	92,103	821,812	152,294	155,419
Retired pay	213,446	221,283	224,454	659,183	6,354	7,671
Undistributed	4,082	−73,733	20,580	−49,071	—	49,071
Total—Military Personnel	1,954,639	2,091,910	2,175,741	6,222,200	750,956	1,055,318
Operation and Maintenance	1,572,248	2,094,710	1,708,818	5,375,776	3,924,991	4,432,889
Procurement						
Aircraft	673,160	774,661	614,825	2,062,646	7,701,062	6,700,317
Missiles	188,363	205,320	272,577	666,269	2,616,998	2,495,476
Ships	159,804	181,541	185,308	526,653	3,085,253	2,961,361
Tracked combat vehicles	−6,218	36,640	26,239	56,661	454,414	447,567
Ordnance, vehicles and related equipment	215,369	375,776	494,848	1,085,993	5,690,581	5,673,862
Electronics and communications	54,836	101,055	93,972	249,863	1,621,409	1,547,140
Other procurement	146,097	156,179	210,202	512,568	2,016,381	2,007,101
Undistributed	326,717	29,855	−14,391	342,181	128,925	−74,904
Total—Procurement	1,758,127	1,861,036	1,883,671	5,502,834	23,215,023	21,757,915
Research, Development, Test, and Evaluation						
Military sciences	59,643	80,317	73,303	213,263	712,919	715,698
Aircraft	98,202	97,838	99,618	295,658	681,935	853,572
Missiles	151,617	183,973	206,610	542,200	1,077,605	1,271,898
Astronautics	98,139	63,715	71,935	233,789	452,428	476,730
Ships	22,803	34,527	25,225	82,555	284,836	359,974
Ordnance, vehicles and related equipment	24,601	27,529	28,709	80,839	229,411	262,978
Other equipment	60,426	86,585	79,236	226,247	501,780	589,734
Program-wide management and support	51,621	22,709	31,748	106,078	282,019	275,280
Undistributed	27,988	16,488	4,470	48,946	38,151	−15,094
Total—Research, Development, Test, & Evaluation	595,040	613,683	620,853	1,829,576	4,261,084	4,790,774
Military Construction	100,941	136,828	112,517	350,286	1,806,093	1,578,475
Family Housing	44,603	55,062	52,703	152,368	256,946	230,662
Civil Defense	5,743	8,818	6,802	21,363	55,255	50,188
Other—Special Foreign Currency Program	2	72	34	108	363	384
Revolving and Management Funds	319,666	−238,747	−68,662	12,257	6,615,240	7,030,635
Applicable Receipts	−7,273	−10,116	−13,046	−30,435	—	—
Subtotal—Federal Funds	6,434,736	6,613,255	6,479,431	19,436,422	40,885,950	40,927,247
Trust Funds	1,977	−1,237	−814	−74	4,534	4,132
Interfund Transactions	—	—	−8	−3	—	—
Total—Military Functions	6,345,714	6,612,017	6,478,614	19,436,345	40,890,483	40,931,378
Military Assistance						
Federal Funds	12,123	57,652	53,300	123,075	1,562,839	1,511,537
Trust Funds	−28,003	−2,670	23,932	−6,741	227,015	205,204
Total—Military Assistance	−15,880	54,983	77,231	116,334	1,789,854	1,716,741
TOTAL—DEPARTMENT OF DEFENSE	6,329,834	6,667,000	6,555,845	19,552,679	42,680,337	42,648,120

Department of the Army

Department of the Army	July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	At start of year	As of 30 Sept 1969
Military Personnel						
Active forces	583,427	746,902	758,100	2,088,429	213,798	412,707
Reserve forces	73,383	86,384	63,275	223,042	115,658	110,068
Undistributed	5,324	−89,979	14,715	−69,940	—	69,940
Total—Military Personnel	662,134	743,307	836,090	2,241,531	329,457	592,715
Operation and Maintenance	556,921	720,486	569,809	1,847,216	1,337,348	1,529,125
Procurement						
Aircraft	86,989	76,405	65,008	228,402	1,063,782	918,188
Missiles	29,225	46,707	75,721	151,653	848,404	791,087
Tracked combat vehicles	−6,537	33,429	24,058	50,950	431,068	420,310
Ordnance, vehicles and related equipment	65,374	159,246	295,424	520,044	2,965,280	2,789,647
Electronics and communications	−58	36,793	37,556	74,291	581,475	542,295
Other procurement	407	50,251	41,212	91,870	682,896	628,653
Undistributed	319,473	28,669	27,328	320,814	39,722	−141,540
Total—Procurement	494,873	431,500	511,651	1,438,024	6,612,627	5,907,640
Research, Development, Test, & Evaluation						
Military sciences	9,301	10,500	13,535	33,336	96,888	123,295
Aircraft	3,411	7,129	4,562	15,102	89,782	86,616
Missiles	85,252	57,925	96,406	189,583	419,831	457,669
Astronautics	844	490	431	1,765	3,813	3,563
Ordnance, vehicles and related equipment	11,695	16,046	13,567	41,308	115,667	194,372
Other equipment	16,914	31,775	27,405	76,094	196,095	212,442
Program-wide management and support	6,491	4,297	4,571	15,359	82,104	83,685
Undistributed	26,752	8,134	−4,306	30,580	13,651	−18,412
Total—Research, Development, Test, & Evaluation	110,660	136,296	166,171	403,127	967,831	1,033,250
Military Construction	83,260	48,924	41,673	123,857	776,104	741,609
Revolving and Management Funds	165,738	−3,646	−33,019	129,073	1,856,891	1,781,203
Applicable Receipts	−3,728	−4,801	−4,845	−13,374	—	—
Subtotal—Federal Funds	2,019,861	2,072,063	2,077,529	6,169,453	11,880,257	11,585,521
Trust Funds	2,309	−1,245	−1,305	−241	89	−47
TOTAL—DEPARTMENT OF THE ARMY	2,022,170	2,070,817	2,076,225	6,169,212	11,880,346	11,585,477

Department of the Navy

	Outlays				Unpaid obligations	
	July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	At start of year	As of 30 Sept 1969
Military Personnel						
Active forces	500,071	528,935	534,395	1,563,401	168,734	256,380
Reserve forces	15,916	17,573	13,668	47,157	23,320	31,698
Undistributed	−1,151	13,629	7,143	19,621	—	−19,621
Total—Military Personnel	514,836	560,137	555,206	1,630,179	192,054	268,397
Operation and Maintenance	403,147	693,570	440,794	1,537,511	1,597,613	1,577,810
Procurement						
Aircraft	222,634	200,045	192,628	615,307	2,861,615	2,411,739
Missiles	57,856	45,549	56,421	159,826	703,716	723,984
Ships	159,804	181,541	185,308	526,653	3,085,259	2,961,361
Tracked combat vehicles	319	3,211	2,181	5,711	23,346	18,247
Ordnance, vehicles and related equipment	90,617	124,935	110,795	326,347	1,536,287	1,528,909
Electronics and communications	34,892	37,923	26,052	98,867	576,715	542,286
Other procurement	84,884	65,680	96,668	247,232	1,194,841	1,233,543
Undistributed	1,352	−2,065	15,384	14,671	71,369	55,148
Total—Procurement	652,358	666,810	685,438	1,994,615	10,053,142	9,475,210
Research, Development, Test, & Evaluation						
Military sciences	11,642	15,706	15,044	42,392	129,992	134,770
Aircraft	28,277	44,183	46,510	118,970	253,929	399,085
Missiles	42,446	46,539	54,889	143,874	291,240	318,702
Astronautics	951	2,287	1,156	4,394	15,598	16,697
Ships	22,803	34,527	25,225	82,555	284,836	359,974
Ordnance, vehicles and related equipment	12,906	11,483	15,142	39,531	113,744	128,606
Other equipment	10,775	14,784	14,552	40,111	77,139	150,004
Program-wide management and support	22,842	−11,415	4,642	16,069	219,464	190,187
Undistributed	−1,637	2,163	2,949	3,475	14,446	9,644
Total—Research, Development, Test, & Evaluation	151,005	160,257	180,109	491,371	1,400,388	1,707,668
Military Construction	31,857	41,348	32,241	105,446	616,207	504,022
Revolving and Management Funds	113,579	−198,084	24,232	−60,273	2,199,935	2,288,606
Applicable receipts	−1,789	−3,259	−4,519	−9,567	—	—
Subtotal—Federal Funds	1,864,992	1,910,789	1,913,501	5,689,282	15,999,338	15,821,719
Trust Funds	54	527	959	1,540	122	152
Interfund Transactions	—	—	−3	−3	—	—
TOTAL—DEPARTMENT OF THE NAVY	1,865,046	1,911,316	1,914,457	5,690,819	15,999,460	15,821,871

Department of the Air Force

Military Personnel						
Active forces	549,676	542,751	546,109	1,638,536	209,774	174,070
Reserve forces	14,638	21,815	15,160	51,613	13,316	13,713
Undistributed	−91	2,617	−1,278	1,248	—	−1,248
Total—Military Personnel	564,223	567,183	559,991	1,691,397	223,090	186,535
Operation and Maintenance	519,009	576,893	609,840	1,705,742	953,240	1,201,466
Procurement						
Aircraft	363,537	498,211	357,189	1,218,937	3,775,665	3,370,300
Missiles	101,282	113,073	140,435	354,790	964,878	980,405
Ordnance, vehicles and related equipment	59,370	91,473	88,600	239,443	1,188,875	1,405,174
Electronics and communications	19,673	24,872	29,843	74,388	455,843	457,292
Other procurement	59,174	37,812	68,069	165,055	95,195	99,976
Undistributed	5,422	3,636	−2,492	6,565	17,834	11,619
Total—Procurement	608,457	769,076	681,645	2,059,178	6,498,290	6,324,856
Research, Development, Test, & Evaluation						
Military sciences	11,526	13,507	5,576	30,609	90,842	99,346
Aircraft	66,514	46,526	48,546	161,586	338,224	367,871
Missiles	73,919	79,509	55,315	208,743	360,594	495,527
Astronautics	96,344	60,938	70,348	227,630	433,017	456,476
Other equipment	32,737	40,026	37,279	110,042	228,540	227,288
Program-wide management and support	22,288	29,827	22,535	74,650	30,451	51,408
Undistributed	2,873	6,191	5,827	14,891	10,054	−6,326
Total—Research, Development, Test, & Evaluation	306,201	276,525	245,426	828,152	1,497,668	1,691,589
Military Construction	35,290	44,542	37,899	117,737	393,810	314,798
Revolving and Management Funds	28,509	−4,925	−80,308	−56,664	1,276,941	1,773,254
Applicable Receipts	−1,757	−2,052	−3,678	−7,487	—	—
Subtotal—Federal Funds	2,059,097	2,227,243	2,050,815	6,338,055	10,843,039	11,492,498
Trust Funds	−386	−518	−469	−1,373	4,323	4,027
TOTAL—DEPARTMENT OF THE AIR FORCE	2,059,611	2,226,725	2,050,346	6,336,682	10,847,362	11,496,525

Defense Agencies/Office of the Secretary of Defense

Defense Agencies/Office of the Secretary of Defense	Outlays				Unpaid obligations	
	July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	At start of year	As of 30 Sept 1969
Military Personnel						
Retired Pay	213,446	221,283	224,454	659,183	6,354	7,671
Operation and Maintenance	93,172	103,760	88,375	285,307	96,790	124,487
Procurement						
Ordnance, vehicles and related equipment	8	122	29	159	139	132
Electronics and communications	829	1,467	521	2,317	7,376	5,273
Other procurement	1,632	2,436	4,343	8,411	43,449	44,929
Undistributed	470	—384	45	131	—	—131
Total—Procurement	2,439	3,641	4,938	11,018	50,964	50,203
Research, Development, Test, & Evaluation						
Military sciences	27,174	40,604	39,148	106,926	395,197	358,287
Military Construction	529	2,013	704	3,246	19,972	18,046
Family Housing	44,603	55,062	52,703	152,368	256,946	230,662
Other—Special Foreign Currency Program	2	72	34	108	363	384
Revolving and Management Funds	11,781	—32,093	20,434	122	1,281,474	1,187,574
Applicable Receipts	—1	—2	—4	—7	—	—
Subtotal—Federal Funds	393,144	394,341	430,785	1,218,270	2,108,061	1,977,316
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	393,144	394,341	430,785	1,218,270	2,108,061	1,977,316

Office of Civil Defense

Civil Defense	5,743	8,818	6,802	21,363	55,265	50,189

Obligations

Department of Defense	Available for obligation	Obligations				Unobligated balance 30 Sept 1969
		July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	
	(*)					(*)
Military Personnel						
Active forces		1,903,308	1,855,277	1,860,200	5,618,885	
Reserve forces		140,418	110,245	73,889	324,552	
Retired pay		214,681	221,452	224,212	660,345	
Total—Military Personnel		2,258,408	2,187,074	2,158,301	6,603,783	
Operation and Maintenance		2,557,164	2,029,853	1,797,625	6,384,632	
Procurement						
Aircraft		229,749	376,800	585,682	1,192,231	
Missiles		138,719	146,276	378,767	663,762	
Ships		139,240	121,066	148,960	409,866	
Tracked combat vehicles		770	10,737	71,807	83,314	
Ordnance, vehicles and related equipment		107,798	427,421	1,046,764	1,581,983	
Electronics and communications		48,464	72,455	93,574	214,493	
Other procurement		185,920	153,949	244,874	584,743	
Undistributed		127	−413	−541	−827	
Total—procurement		850,788	1,308,888	2,569,888	4,729,564	
Research, Development, Test, & Evaluation						
Military sciences		88,897	70,284	72,430	231,611	
Aircraft		53,970	282,726	137,061	473,757	
Missiles		419,057	225,227	142,949	787,233	
Astronautics		139,849	72,943	59,412	272,204	
Ships		71,138	54,427	37,358	162,923	
Ordnance, vehicles and related equipment		35,211	58,140	23,010	116,361	
Other equipment		122,223	107,516	93,605	323,344	
Program-wide management and support		78,738	34,045	62,601	175,284	
Emergency fund		—	—	—	—	
Undistributed		−500	−83	−482	−1,015	
Total—Research, Development, Test, & Evaluation		1,008,583	905,276	627,841	2,541,701	
Military Construction		60,569	109,424	104,351	274,344	
Family Housing		61,388	35,557	32,165	129,110	
Civil Defense		4,831	5,901	5,548	16,280	
Other—Special Foreign Currency		42	87	—	129	
Revolving and Management Funds		2,437,298	2,119,974	1,582,244	6,139,516	
Applicable Receipts		−7,678	−9,796	−11,106	−28,580	
Subtotal—Federal Funds		9,231,383	8,692,238	8,866,857	26,790,478	
Trust Funds		1,963	5,092	1,528	8,583	
Interfund Transactions		—	−2	−2,582	−2,584	
Total—Military Functions		9,233,345	8,697,331	8,865,800	26,796,476	
Military Assistance						
Federal Funds		99,249	10,064	12,724	122,037	
Trust Funds		−29,190	−19,064	19,702	−28,552	
Total—Military Assistance		70,059	−9,001	32,427	93,485	
TOTAL—DEPARTMENT OF DEFENSE		9,303,404	8,688,331	8,808,226	26,889,961	

*In OBLIGATIONS portion of Status of Funds Report, First Quarter, FY 1970, under column heads "Available for Obligation" and "Unobligated Balance, 30 Sept 1969," figures were not compiled at the time report was issued because FY 1970 appropriation authorizations for the Defense Department had not been approved by Congress.

Department of the Army

	Available for obligation	Obligations				Unobligated balance 30 Sept 1969
		July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	
	(*)					(*)
Military Personnel						
Active forces		790,925	740,600	782,036	2,313,561	
Reserve forces		105,349	66,347	46,016	217,712	
Total—Military Personnel		896,274	806,948	828,051	2,531,273	
Operation and Maintenance		1,008,231	667,606	596,063	2,271,900	
Procurement						
Aircraft		2,619	63,852	22,846	89,316	
Missiles		11,388	18,683	76,174	106,245	
Tracked combat vehicles		307	10,888	71,507	82,702	
Ordnance, vehicles and related equipment		88,417	138,908	578,853	806,178	
Electronics and communications		5,774	15,475	27,986	49,235	
Other procurement		10,966	28,024	25,323	64,313	
Undistributed		127	−413	343	57	
Total—Procurement		119,598	275,412	803,031	1,198,041	
Research, Development, Test, & Evaluation						
Military sciences		29,508	20,330	16,029	65,867	
Aircraft		4,277	3,287	6,334	13,898	
Missiles		129,653	50,028	53,551	233,232	
Astronautics		424	400	691	1,515	
Ordnance, vehicles and related equipment		25,947	20,962	15,185	62,094	
Other equipment		24,485	41,564	32,746	98,795	
Program-wide management and support		9,258	4,218	4,338	17,814	
Undistributed		−500	−33	−82	−615	
Total—Research, Development, Test, & Evaluation		223,052	140,756	128,792	492,600	
Military Construction		29,227	81,699	29,469	140,395	
Revolving and Management Funds		482,677	461,257	424,302	1,368,236	
Applicable receipts		−3,828	−4,780	−4,763	−13,371	
Subtotal—Federal Funds		2,755,232	2,328,898	2,804,944	7,989,074	
Trust Funds		1	3,399	−1	−3,399	
TOTAL—DEPARTMENT OF THE ARMY		2,755,233	2,432,297	2,804,943	7,992,473	

Department of the Navy

Military Personnel				
Active forces	559,670	565,803	536,444	1,661,917
Reserve forces	20,594	20,663	14,342	55,599
Total—Military Personnel	580,264	586,466	550,786	1,717,516
Operation and Maintenance	450,938	686,432	580,414	1,717,784
Procurement				
Aircraft	16,149	72,366	97,693	186,208
Missiles	31,814	17,099	136,171	185,084
Ships	139,240	121,666	148,960	409,866
Tracked combat vehicles	463	−151	300	612
Ordnance, vehicles and related equipment	−7,016	164,707	162,224	319,915
Electronics and communications	19,975	18,609	27,967	66,551
Other procurement	114,606	88,803	136,152	339,560
Undistributed	—	—	−1,187	−1,187
Total—Procurement	315,231	483,008	708,279	1,506,608
Research, Development, Test, & Evaluation				
Military sciences	32,974	6,069	9,618	48,661
Aircraft	29,907	195,796	38,448	264,151
Missiles	111,298	57,924	9,888	179,110
Astronautics	908	2,817	1,768	5,493
Ships	71,138	54,427	37,358	162,923
Ordnance, vehicles and related equipment	9,264	37,178	7,825	54,267
Other equipment	67,588	29,176	17,041	113,805
Program-wide management and support	23,348	3,466	32,312	59,126
Undistributed	—	—	—	—
Total—Research, Development, Test, & Evaluation	346,425	386,853	154,258	887,536
Military Construction	19,217	14,945	60,264	94,426
Revolving and Management Funds	573,167	904,383	628,126	2,105,676
Applicable Receipts	−1,789	−3,257	−1,939	−6,985
Subtotal—Federal Funds	2,283,454	3,058,919	2,680,188	8,022,561
Trust Funds	136	778	879	1,793
Interfund Transactions	—	−2	−2,582	−2,584
TOTAL—DEPARTMENT OF THE NAVY	2,283,589	3,059,696	2,678,485	8,021,770

*In OBLIGATIONS portion of Status of Funds Report, First Quarter, FY 1970, under column heads "Available for Obligation" and "Unobligated Balance, 30 Sept 1969," figures were not compiled at the time report was issued because FY 1970 appropriation authorizations for the Defense Department had not been approved by Congress.

Department of the Air Force

Department of the Air Force	Available for obligation	Obligations July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	Unobligated balance 30 Sept 1969
Military Personnel						
Active forces	(*)	552,712	548,975	541,720	1,643,407	(*)
Reserve forces		14,475	23,235	13,531	51,241	
Total—Military Personnel		567,189	572,208	555,251	1,694,648	
Operation and Maintenance		975,157	575,848	519,843	2,070,848	
Procurement						
Aircraft		210,981	240,582	465,144	916,707	
Missiles		95,517	110,494	166,422	372,433	
Ordnance, vehicles and related equipment		26,393	123,689	305,661	455,743	
Electronics and communications		22,597	38,218	37,678	98,493	
Other procurement		58,751	36,182	74,903	169,836	
Undistributed		—	—	303	303	
Total—Procurement		414,240	549,166	1,050,109	2,013,515	
Research, Development, Test, & Evaluation						
Military sciences		17,141	17,093	11,301	45,535	
Aircraft		19,786	83,643	92,279	195,708	
Missiles		178,106	117,275	79,510	374,891	
Astronautics		138,517	69,726	56,953	265,196	
Other equipment		30,150	36,776	43,818	110,744	
Program-wide management and support		46,132	26,361	25,851	98,344	
Undistributed		—	—	−400	−400	
Total—Research, Development, Test, & Evaluation		429,832	350,875	309,310	1,090,017	
Military Construction		8,914	14,829	14,460	38,203	
Revolving and Management Funds		1,097,766	490,067	300,817	1,888,650	
Applicable Receipts		−2,059	−1,758	−3,672	−7,489	
Subtotal—Federal Funds		3,491,039	2,561,235	2,746,117	8,788,391	
Trust Funds		1,826	916	648	3,390	
TOTAL—DEPARTMENT OF THE AIR FORCE		3,492,864	2,552,154	2,746,763	8,791,781	

Defense Agencies/Office of the Secretary of Defense

Defense Agencies/Office of the Secretary of Defense	Available for obligation	July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	Unobligated balance 30 Sept 1969
Military Personnel						
Retired pay		214,681	221,452	224,212	660,345	
Operation and Maintenance		122,827	99,968	101,305	324,100	
Procurement						
Ordnance, vehicles and related equipment		4	122	26	152	
Electronics and communications		118	149	−53	214	
Other procurement		1,598	940	8,497	11,034	
Undistributed		—	—	—	—	
Total—Procurement		1,720	1,211	8,469	11,400	
Research, Development, Test, & Evaluation						
Military sciences		9,274	26,792	35,482	71,548	
Emergency fund		—	—	—	—	
Undistributed		—	—	—	—	
Total—Research, Development, Test, & Evaluation		9,274	26,792	35,482	71,548	
Military Construction		3,212	−2,051	159	1,320	
Family Housing		61,388	35,567	32,166	120,110	
Other—Special Foreign Currency Program		42	87	—	129	
Revolving and Management Funds		283,688	264,266	229,000	776,954	
Applicable Receipts		−1	−2	−732	−735	
Subtotal—Federal Funds		696,829	647,281	630,060	1,974,170	
Trust Funds		—	—	—	—	
TOTAL—DEFENSE AGENCIES/OSD		696,829	647,281	630,060	1,974,170	

Office of Civil Defense

Office of Civil Defense	Available for obligation	July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	Unobligated balance 30 Sept 1969
Civil Defense		4,831	5,901	5,548	16,280	

Military Assistance

Military Assistance	Available for obligation	July 1969	August 1969	September 1969	Cum thru 30 Sept 1969	Unobligated balance 30 Sept 1969
Federal Funds		99,249	10,064	12,724	122,037	
Trust Funds		−29,190	−19,064	19,702	−28,552	
TOTAL—MILITARY ASSISTANCE		70,059	−9,001	32,426	93,485	

*In OBLIGATIONS portion of Status of Funds Report, First Quarter, FY 1970, under column heads "Available for Obligation" and "Unobligated Balance, 30 Sept 1969," figures were not compiled at the time report was issued because FY 1970 appropriation authorizations for the Defense Department had not been approved by Congress.

NOTE: All outlay amounts are on a net Treasury basis (gross payments less reimbursement collections), whereas obligations and unpaid obligations are on a gross basis (inclusive of reimbursable activity performed by components of DOD for each other). Therefore, unpaid obligations as of the end of the reporting month cannot be computed from other figures in this report.

Prepared by:

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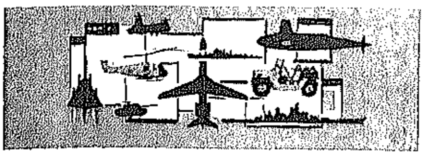

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of December 1969.

DEFENSE SUPPLY AGENCY

3—**Pettibone Mulliken Corp.**, Washington, D.C. $3,851,610. 105 rough terrain fork lift trucks. Defense General Supply Center, Richmond, Va. DSA 400-69-C-5415.

4—**Lester D. Lawson and Co.**, Long Beach, Calif. $3,760,264. 131,340 cases of ration supplement sundries pack. San Diego, Calif. Defense Personnel Support Center, Philadelphia, Pa. DSA 130-70-C-T025.

9—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts for leather combat boots:

Sportwelt Shoe Co., Nashua, N.H. $1,424,246. 153,990 pairs. Newport, N.H. DSA 100-70-C-1074.

Endicott Johnson Corp., Endicott, N.Y. $1,380,000. 150,000 pairs. Johnson City, N.Y. DSA 100-70-C-1075.

Altama Delta Corp., Darien, Ga. $1,083,000. 120,000 pairs. DSA 100-70-C-1076.

Genesco, Inc., Nashville, Tenn. $5,578,595. 635,740 pairs. Huntsville, Ala. DSA 100-70-C-1077.

Addison Shoe Corp., Wynne, Ark. $3,116,997. 360,000 pairs.

10—**Plastoid Corp.**, Hamburg, N.J. $2,582,990. 50,204 one-mile reels of telephone cable. Defense Industrial Supply Center, Philadelphia, Pa. DSA 500-70-C-4253.

12—**Caterpillar Tractor Co.**, Peoria, Ill. $3,140,501. 169 motorized road graders. Decatur, Ill. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-8386.

—**Allis Chalmers Co.**, Milwaukee, Wis. $2,217,261. 323 6,000-pound capacity fork lift trucks. Harvey, Ill. Defense General Supply Center, Richmond, Va. DSA 400-70-C-2807.

—**Winthrop Laboratories**, New York, N.Y. $1,974,839. 191,732 bottles of cloroquine and primaquine phosphate tablets. Rensselaer, N.Y. Defense Personnel Support Center, Philadelphia, Pa. DSA 120-70-C-1136.

—**Hyster Co.**, Portland, Ore. $1,006,346. 94 15,000-pound capacity fork lift trucks. Danville, Ill. Defense General Supply Center, Richmond, Va. DSA 400-70-C-2806.

—The following contracts for JP-5 jet fuel were issued by the Defense Fuel Supply Center, Alexandria, Va.:

Mobil Oil Corp., New York, N.Y. $14,436,500. 152,000,000 gallons. DSA 600-70-D-0770.

Golden Eagle Refining Co., Inc., Los Angeles, Calif. $5,512,821. 46,200,000 gallons. DSA 600-70-D-0704.

Douglas Oil Co. of Calif., Los Angeles, Calif. $3,234,000. 28,000,000 gallons. DSA 600-70-D-0760.

Humble Oil and Refining Co., Houston, Tex. $2,851,230. 26,300,000 gallons. DSA 600-70-D-0766.

Powerine Oil Co., Santa Fe Springs, Calif. $2,192,333. 19,500,000 gallons. DSA 600-70-D-0772.

Phillips Petroleum Co., Bartlesville, Okla. $1,725,690. 14,146,000 gallons. DSA 600-70-D-0771.

Fletcher Oil and Refining Co., Carson, Calif. $1,599,342. 13,900,000 gallons. DSA 600-70-D-0761.

Sun Oil Co., Philadelphia, Pa. $1,466,911. 13,451,333 gallons. DSA 600-70-D-07/3.

Gulf Oil Co., Houston, Tex. $1,309,216. 12,639,000 gallons. DSA 600-70-D-0762.

—The following contracts for Navy special fuel oil were issued by the Defense Fuel Supply Center:

Texaco Export, Inc., New York, N.Y. $7,632,650. 5,350,000 barrels. DSA 600-70-D-0897.

Powerine Oil Co., Santa Fe Springs, Calif. $4,980,080. 2,100,000 barrels. DSA 600-70-D-0802.

Asiatic Petroleum Corp., New York, N.Y. $1,359,000. 900,000 barrels. DSA 600-70-D-0888.

Union Oil Co. of Calif., Los Angeles, Calif. $5,768,250. 2,550,000 barrels. DSA 600-70-D-0898.

—The Defense Fuel Supply Center awarded the following contracts:

Hess Oil and Chemical Corp., Woodridge, N.J. $3,364,725. 850,000 barrels of diesel marine fuel oil. DSA 600-70-D-0891.

Union Oil Co. of Calif., Los Angeles, Calif. $4,057.750. 500,000 barrels diesel arctic fuel oil and 350,000 barrels diesel marine fuel oil. DSA 600-70-D-0885.

Atlantic Richfield Co., Los Angeles, Calif. $3,260,805. 745,000 barrels diesel marine fuel oil. DSA 600-70-D-0886. $2,624,000. 800,000 barrels Navy special fuel oil and 500,000 barrels #6 fuel oil. DSA 600-70-D-0889.

Standard Oil of Calif., San Francisco, Calif. $2,107,000. 100,000 barrels gasoline and 900,000 barrels #6 fuel oil. DSA 600-70-D-0804.

15—**Air Logistics Corp.**, Pasadena, Calif. $1,106,146. Momat kits and assault trackways for the Navy and Marine Corps. Defense Construction Supply Center, Columbus, Ohio. DSA 700-69-C-H-525-PZ04.

16—**A. H. Helmig and Co., Inc.**, Narberth, Pa. $1,070,186. 1,009,087 pounds of scoured wool. Philadelphia, Pa. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1089.

19—The following contracts for JP-4 jet fuel were issued by the Defense Fuel Supply Center, Alexandria, Va.:

Humble Oil & Refining Co., Houston, Tex. $21,600,604. 211,503,000 gallons. DSA 600-70-D-0817.

American Oil Co., Chicago, Ill. $8,458,645. 81,326,600 gallons. DSA 600-70-D-0776.

Continental Oil Co., Houston, Tex. $3,212,532. 31,367,000 gallons. DSA 600-70-D-0792.

Leonard Refineries, Inc., Alma, Mich. $3,694,184. 36,830,000 gallons. DSA 600-70-D-0825.

Mobil Oil Corp., New York, N.Y. $19,270,552. 185,500,000 gallons. DSA 600-70-D-0831.

Phillips Petroleum Co., Bartlesville, Okla. $3,815,727. 33,087,000 gallons. DSA 600-70-D-0836.

Standard Oil Co. of Calif. (Western Operations, Inc.), San Francisco, Calif. $6,332,636. 57,558,924 gallons. DSA 600-70-D-0841.

Sun Oil Co., Tulsa, Okla. $2,823,000. 30,000,000 gallons. DSA 600-70-D-0847.

Texaco, Inc., Long Island City, N. Y. $4,834,368. 50,400,000 gallons. DSA 600-70-D-0849.

Mene Grande Oil Co. (c/o Gulf Trading Co.), Washington, D.C. $2,948,400. 40,950,000 gallons. DSA 600-70-D-0859.

Union Oil Co. of California, Los Angeles. $7,563,647. 67,118,120 gallons. DSA 600-70-D-0855.

Sun Oil Co., Philadelphia, Pa. $2,209,480. 26,000,000 gallons. DSA 600-70-D-0953.

Hess Oil-Virgin Island Corp., St. Croix, U. S. Virgin Islands. $7,276,500. 118,400,000. DSA 600-70-D-0814.

Howell Refining Co., San Antonio, Tex. $3,067,212. 27,000,000 gallons. DSA 600-70-D-0819.

Kern County Refining, Inc., Los Angeles, Calif. $2,457,651. 20,845,800 gallons. DSA 600-70-D-0821.

MacMillan Ring-Free Oil, Inc., Los Angeles, Calif. $4,152,106. 36,957,000 gallons. DSA 600-/0-D-0829.

Longview Refining Co., Houston, Tex. $1,011,933. 9,000,000 gallons. DSA 600-70-D-0823.

Wing Corp., San Antonio, Tex. $1,449,566. 13,000,000 gallons. DSA 600-70-D-0828.

Navajo Refining Co., Artesia, N. M. $3,402,000. 30,000,000 gallons. DSA 600-70-D-0833.

Atlantic Richfield Co., Los Angeles, Calif. $1,627,020. 14,280,000 gallons. DSA 600-70-D-0779.

Ashland Oil & Refining Co., Ashland, Ky. $2,971,230. 27,280,000 gallons. DSA 600-70-D-0778.

American Petrofina Co., Dallas, Tex. $2,928,236. 21,335,000 gallons. DSA 600-70-D-0/85.

Alabama Refining Co., Theodore, Ala. $1,396,341. 14,500,000 gallons. DSA 600-70-D-0781.

Adobe Refining Co., La Blanca, Tex. $1,754,565. 15,000,000 gallons. DSA 600-70-D-0784.

Delta Refining Co., Memphis, Tenn. $5,106,212. 48,070,000 gallons. DSA 600-70-D-0799.

Coastal States Petrochemical Co., Houston, Tex. $4,803,433. 40,500,000 gallons. DSA 600-70-D-0791.

Chevron Oil Co., Denver, Colo. $1,003,087. 14,009,276 gallons. DSA 600-70-D-0790.

Bayou Refining Co., Inc., Pasadena, Tex. $2,112,365. 22,280,000 gallons. DSA 600-70-D-0787.

Tonkawa Refining Co., Houston, Tex. $2,272,210. 22,000,000 gallons. DSA 600-70-D-0850.

Tesoro Petroleum Corp., San Antonio, Tex. $4,330,610. 36,500,000 gallons. DSA 600-70-D-0853.

Tesoro-Alaskan Petroleum Corp., San Antonio, Tex. $5,108,120. 40,000,000 gallons. DSA 600-70-D-0852.

Sun Oil Co., Philadelphia, Pa. $4,838,000. 46,000,000 gallons. DSA 600-70-D-0842.

Southland Oil Co., Yazoo City, Miss. $1,088,358. 10,500,000 gallons. DSA 600-70-D-0848.

Hess Oil & Chemical Div., Amerada Hess Corp., Woodbridge, N. J. $1,240,000. 12,000,000 gallons. DSA 600-70-D-0818.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

Pride Refining, Inc., Abilene, Tex. $2,-018,545. 18,000,000 gallons. DSA 600-70-D-0839.

Okmulgee Refining Co., Inc., Okmulgee, Okla. $5,471,948. 55,730,000 gallons. DSA 600-70-D-0834.

Triangle Refining, Inc., Houston, Tex. $2,123,853. 19,350,000 gallons. DSA 600-70-D-0851.

Hercules Oil Co. of San Diego, Long Beach, Calif. $1,670,540. 14,714,000 gallons. DSA 600-70-D-0816.

Good Hope Refineries, Inc., Houston, Tex. $5,332,218. 55,100,000 gallons. DSA 600-70-D-0812.

Golden Eagle Refining Co., Los Angeles, Calif. $6,697,873. 58,800,000 gallons. DSA 600-70-D-0810.

Fort Worth Refining Co., Fort Worth, Tex. $2,928,236. 28,000,000. DSA 600-70-D-0807.

Famariss Oil & Refining Co., Hobbs, N. M. $1,394,458. 12,000,000 gallons. DSA 600-70-D-0805.

Edgington Oil Co., Long Beach, Calif. $2,329,727. 20,500,000 gallons. DSA 600-70-D-0803.

Douglas Oil Co. of California, Los Angeles. $5,324,000. 50,000,000 gallons. DSA 600-70-D-0801.

Diamond Shamrock Corp., Amarillo, Tex. $1,907,825. 16,800,000 gallons. DSA 600-70-D-0802.

29—Gibraltar Fabrics, Inc., Brooklyn, N. Y. $1,397,083. 229,030 camouflaged poncho liners. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1204.

DEPARTMENT OF THE ARMY

1—Chamberlain Manufacturing Corp., Elmhurst, Ill. $13,026,871. Metal parts for 175mm projectiles. Scranton, Pa. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0131.

—Northrop Carolina, Inc., Asheville, N. C. $3,459,264. CS2 riot control agent. Swannanoa, N.C. Edgewood Arsenal, Md. DA-AA15-70-C-0216.

—Thiokol Chemical Corp., Woodbine, Ga. $2,507,610. CS2 riot control agent. Edgewood Arsenal, Md. DA-AA15-70-C-0215.

—Norris Industries, Inc., Los Angeles, Calif. $1,820,278 (contract modification). Production support and maintenance, Army Ammunition Plant, Riverbank, Calif. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-11-173-AMC-00998(A).

—Teichert and Sons, Inc., Sacramento, Calif. $1,222,240. River bank protection on the Sacramento River Levee, Calif. Army Engineer District, Sacramento, Calif. DA-CW05-70-C-0049

2—Standard Container Co., Montclair, N.J. $3,686,500. Metal boxes for small caliber ammunition. Homerville, Ga. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0292.

—Thiokol Chemical Corp., Woodbine, Ga. $1,391,432. Surface flares. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0270.

—William Clairmont, Inc., Bismarck, N.D. $1,235,999. Work on the Missouri River levee system near Bellevue, Neb. Army Engineer District, Omaha, Neb. DA-CW45-70-C-0042.

3—Hughes Aircraft Co., Culver City, Calif. $64,400,000. TOW missiles. Culver City and Tucson, Ariz. DA-AH01-68-C-2141. $4,-850,000. FY 1970 ground support equipment for the TOW missile. Culver City and El Segundo, Calif. DA-AH01-70-C-0318. Army Missile Command, Huntsville, Ala.

'er Trailers, Inc., Bradenton, Fla. $1,-'6. 6-ton electronic van semitrailers (M373A5). Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-1904.

—Stanley Consultants, Inc., Muscatine, Iowa. $1,031,000. Engineering services on site adaptation of standard design of the Missile Site Radar complex. Army Engineer Division, Huntsville, Ala. DA-CA87-70-C-0004.

—Western Electric Co., New York, N.Y. $7,119,560 (contract modification). Spartan missile. McDonnell Douglas Corp., Santa Monica, Calif., and other subcontractors. $4,899,600 (contract modification). Missile site radar. Raytheon Co., Bedford, Mass., and other subcontractors. Safeguard System Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

4—Hansel Phelps Construction Co., Greeley, Colo. Construction of the Dent Bridge over the north fork of the Clearwater River, Dworshak Dam and Reservoir project, near Orofino, Idaho. Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0044.

—Institute for Defense Analysis, Arlington, Va. $1,079,137 (contract modification). Basic and applied research for the Dir. for Defense Research and Engineering, and the Advanced Research Projects. Defense Supply Service, Washington, D.C. DA-HC-67-C-0011.

—Paramus-Fairchild Camera and Instrument Corp., Paramus, N.J. $1,387,500. Research and development on AN/ALQ-67(XE-5) countermeasures sets. Procurement Division, Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0019.

5—Western Electric Co., New York, N.Y. $8,665,270 (contract modification). Additional prototype hardware for the Perimeter Acquisition Radar Tactical Software Control Site and the Missile Site Radar Software Control Site. Raytheon Co., Bedford, Mass., Western Electric, Burlington, N.C., and other subcontractors. Safeguard Systems Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

—Emerson Electric Co., St. Louis, Mo. $2,-198,000. Repair parts for XM28 helicopter armament subsystem. St. Louis and Mt. Pleasant, Iowa. Army Procurement Agency, Chicago, Ill. DA-AG11-70-C-0354.

—Bulova Watch Co., Providence, R.I. $1,-539,350 (contract modification). M525 fuze head assemblies. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0045.

—Hughes Aircraft Co., Culver City, Calif. $4,226,900. AN/TAS-2 long range night observation devices. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0162.

—Ray J. Benoit and Son, Inc., and Van Duyne Brothers, Kankakee, Ill. $2,648,000. Construction of a boiler plant and storage tanks, with supporting utilities, Army Ammunition Plant, Newport, Ind. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0020.

8—Philco-Ford Corp., Newport Beach, Calif. $2,583,787. FY 1970 engineering services for the Chaparral missile system. Anaheim and Newport Beach, Calif. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0460.

—Teledyne Mid America Corp., Hartville, Ohio. $1,456,575. Mounted mine-clearing rollers. Army Mobility Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0186.

9—Texas Instruments, Inc., Dallas, Tex. $4,-500,000. Classified electronic equipment. Army Electronics Command, Fort Monmouth, N.J.

—AVCO Corp., Stratford, Conn. $1,005,000. Modification kits for T-53-L-13 engines for UH-1 helicopters. Army Aviation Systems Command, St. Louis, Mo. AF-41608-69-A-2421.

10—Universal Terminal and Stevedoring Corp., New York, N.Y. $16,072,455. Stevedoring and related services, Military Ocean Terminal, Sunny Point, Southport, N.C., Jan. 1, 1970 to Dec. 31, 1971. Hq., Eastern Area Military Traffic Management and Terminal Service, Brooklyn, N.Y. DA-HC21-70-D-1035.

—Kollsman Instrument Corp., Elmhurst, N.J. $1,466,580. M57 firing devices. Bridgeport, Conn. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0308.

—ITT Corp., Nutley, N.J. $9,257,600 (contract modification). AN/GRC-143 radio sets. Clifton, N.J. Procurement Division, Army Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0001.

—Research Analysis Corp., McLean, Va. $3,000,000 (contract modification). Research and scientific studies of Army tactical operations, and forecasting research and development material requirements. Army Research Office, Arlington, Va. DA-HC19-69-C-0017.

—Baldwin Electronics, Inc., Little Rock, Ark. $1,707,075. Loading, assembling and packing 2.75 inch rocket motors. Camden, Ark. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0806.

11—United States Steel Corp., Pittsburgh, Pa. $1,525,320 (contract modification). M106 8-inch high explosive projectiles. Berwick, Pa. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0226.

—National Presto, Inc., Eau Claire, Wis. $2,699,235 (contract modification). M106 high explosive 8-inch projectiles. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0109.

12—General Motors Corp., Indianapolis, Ind. $1,541,877 (contract modification). Long lead time engineering services and hardware procurement for advanced production of the XM70 Main Battle Tank. Cleveland, Ohio, and Milwaukee, Wis. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-5272.

—Maremont Corp., Saco, Maine. $1,487,130 (contract modification). M60 7.62mm machine guns. Army Weapons Command, Rock Island, Ill. DA-AF08-70-C-0027.

—Frankford Arsenal, Philadelphia, Pa., awarded the following contracts for 20mm cartridge metallic link belts:

Wells Marine, Inc., Costa Mesa, Calif. $1,798,200. 9,000,000. DA-AA25-70-C-0323.

Gulf and Western Industries, Inc., Waukesha, Wis. $1,887,300. 9,000,000. DA-AA25-70-C-0324.

Barry L. Miller Engineering, Inc., Hawthorne, Calif. $1,321,181. 12,700,000. DA-AA25-70-C-0327.

Aluminum Specialty Co., Manitowoc, Wis. $1,347,445. 12,700,000. DA-AA25-70-C-0328.

15—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., awarded the following contracts for metal fuze parts:

Rulon Co., Chicago, Ill. $6,547,800. DA-AA09-70-C-0159.

Keystone Manufacturing Corp., Boston, Mass. $6,370,980. DA-AA09-70-C-0158.

Walter Kidde and Co., Inc., Belleville, N.J. $4,819,500. DA-AA09-70-C-0160.

—Gulf Stevedore Corp., New Orleans, La. $4,914,346. Stevedoring and related terminal services, Mobile, Ala., Jan. 1, 1970 to Dec. 31, 1971. Hq., Eastern Area Military Traffic Management and Terminal Services, Brooklyn, N.Y. DA-HC21-70-D-0138.

—Acton Laboratories, Inc., Acton, Mass. $1,415,520. Telephone signal converters. Army Electronics Command, Philadelphia, Pa. DA-AB05-69-C-1031.

—Consolidated Molded Products, Scranton, Pa. $1,086,720. Metal parts for M18A1 mines. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0314.

—Kollsman Instrument Corp., Elmhurst, N.Y. $1,082,475. Metal parts for M18A1 mines. Bridgeport, Conn. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0315.

16—General Electric Co., Burlington, Vt. $2,-462,500. XM93 armament subsystem pintle mounts for 7.62mm guns. Army Weapons Command, Rock Island Arsenal, Ill. DA-AF03-70-C-0043.

—KDI Precision Products, Inc., Cincinnati, Ohio. $1,536,104. Metal parts of 2.75-inch rocket fuzes. Army Ammunition Procurement Supply Agency, Joliet, Ill. DA-AA09-70-C-0225.

17—Wells Marine, Inc., Costa Mesa, Calif. $1,000,167. 20mm projectiles. Frankford Arsenal, Philadelphia, Pa. DA-AA-25-70-C-0339.

18—Levinson Steel Co., Pittsburgh, Pa. $3,-197,568 (contract modification). 105mm projectiles. Army Ammunition Procure-

ment and Supply Agency, Joliet, Ill. DA-AA09-69-C-0023.

19—**Pacific Intermodal Corp.**, Seattle, Wash. $3,178,416. Container stuffing services involving stowing cargo destined for overseas into vans and CONEXES and the reverse for retrograde cargo from Jan. 1, 1970, thru Dec. 31, 1971. Oakland, Calif. Western Area Military Traffic Management and Terminal Services, Oakland, Calif. DA-HC23-70-D-0005.

—**Kaiser Steel Corp.**, El Monte, Calif. $2,127,975. M2A1 ammunition boxes. Culver City, Calif. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0308.

—**Massachusetts Institute of Technology**, Cambridge, Mass. $1,035,550. Establish and operate a program in computer analyses and modeling in the behavioral sciences. Advanced Research Projects Agency, Washington, D.C. DA-HC15-69-C-0347.

—**Bell & Howell Co.**, Chicago, Ill. $1,229,850. Grenade fuzes. Evanston, Ill. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0013.

—**Bell & Howell Co.**, Chicago, Ill. $1,070,192 (contract modification). Metal parts for M84A1 time fuzes. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0067.

22—**General Motors Corp.**, Indianapolis, Ind. $3,479,171 (contract modification). Engineering services for the M551 vehicle. Cleveland, Ohio. Army Weapons Command, Rock Island Arsenal, Ill. DA-33-019-AMC-00248(W).

—**Chrysler Corp.**, Dayton, Ohio. $1,821,440. Range finders for M60A1 tanks. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0362.

—**R. L. Pohlman Armament Co.**, Maryland Heights, Mo. $1,257,051. M505A3 fuzes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0330.

—**Galion Amco, Inc.**, Galion, Ohio. $1,257,051. M505A3 fuzes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0329.

23—**Uniroyal, Inc.**, New York, N. Y. $40,797,850 (contract modification). Explosives. Joliet, Ill. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-11-173-AMC-00062(A).

—**Olin Mathieson Chemical Corp.**, E. Alton, Ill. $17,302,549 (contract modification). Production of rocket propellant and ammunition components. Charlestown, Ind. Army Ammunition and Supply Agency, Joliet, Ill. DA-AA09-69-C-0148.

—**National Presto Industries**, Eau Clair, Wis. $16,787,400 (contract modification). Metal parts for 8-inch projectiles. Army Ammunition and Supply Agency, Joliet, Ill. DA-AA09-69-C-0109.

—**U.S. Steel Corp.**, Pittsburgh, Pa. $9,577,449. Metal parts for 8-inch projectiles. Berwick, Pa. Army Ammunition and Supply Agency, Joliet, Ill. DA-AA09-70-C-0236.

—**Hercules, Inc.**, Wilmington, Del. $6,684,400 (contract modification). Manufacture artillery propellants and explosives. Radford, Va. Army Ammunition and Supply Agency, Joliet, Ill. DA-11-173-AMC-00037(A).

—**Alcan Aluminum Corp.**, Riverside, Calif. $2,566,277. 66mm rocket motors. Army Ammunition and Supply Agency, Joliet, Ill. DA-AA09-70-C-0230.

—**Western Electric Co.**, New York, N. Y. $4,427,260 (contract modification). Software and programming for Safeguard System. Whippany and Morris Plains, N. J. Safeguard System Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

—**Henry Spen & Co., Inc.**, Brooklyn, N. Y. $1,751,968 (contract modification). 4-ton trailers. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-5307.

—**IBM Corp.**, Gaithersburg, Md. $1,685,740 (contract modification). Procure an additional core type ADP support system. Gaithersburg and Needham Heights, Mass. Army Electronics Command, Arlington, Va. DA-AB07-67-C-0408.

—**Honeywell, Inc.**, Framingham, Mass. $1,000,000. Classified electronics. Army Electronics Command. Ft. Monmouth, N. J.

24—**AVCO Corp.**, Stratford, Conn. $4,850,000. Modification kits for T-53 gas turbine engines for UH-1 helicopters. Army Aviation Systems Command, St. Louis, Mo. F-41608-69-A2421.

—**Wells Marine, Inc.**, Costa Mesa, Calif. $1,350,938. 20mm projectiles. Army Frankford Arsenal, Philadelphia, Pa. DA-AA-25-70-C0361.

29—**AVCO Corp.**, Stratford, Conn. $1,972,099. Turbine nozzles for T-53 helicopter engines. Army Aviation Systems Command, St. Louis, Mo. AF 41608-69-A2421.

—**Mine Safety Appliance Co.**, Pittsburgh, Pa. $10,361,655. 599,575 protective field masks (M17A1). Esmond, R. I. Army Edgewood Arsenal, Edgewood, Md. DA AA-15-67-C0265.

30—**Bauer Ordnance Co.**, Warren, Mich. $1,463,000 (contract modification). Modification of weaponry systems of M-114A1 command and reconnaissance vehicles. Army Tank Automotive Command, Warren, Mich. DA AE-07-68-C-1739.

31—**Western Electric Co.**, New York, N. Y. $230,417,740 (contract modification). Long lead-time components and subassemblies for radars. Allentown, Pa.; Burlington, Greensboro and Winston Salem, N. C.; Syracuse, N. Y.; Orlando, Fla.; Santa Monica and Los Angeles, Calif.; Bedford, Mass.; and Phoenix, Ariz. Army Safeguard System Command, Huntsville, Ala. DA-HC-60-68-C0017.

—**Mason & Hangar, Silas Mason, Inc.**, New York, N. Y. $14,870,367 (contract modification). Loading, assembling and packing detonator primaries and boosters at Army Ammunition Plant, Burlington, Iowa. DA AA-09-68-C-0468. $12,353,306 (contract modification). Loading, assembling and packing heavy bombs at Cornhusker Army Ammunition Plant, Grand Island, Neb. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA AA-09-68-C-0383.

—**Day & Zimmerman, Inc.**, Philadelphia, Pa. $6,000,000. Loading, assembling and packing ammunition components and projectiles, and for operation of the Kansas Army Ammunition Plant, Parsons, Kan. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA AA09-70-C-0245.

—**Atlas Chemical Industries, Inc.**, Wilmington, Del. $2,596,417 (contract modification). Production of TNT and related support services at Volunteer Army Ammunition Plant, Chattanooga, Tenn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA 11-173-AMC-531(A).

—**Hercules Engines, Inc.**, Canton, Ohio. $2,933,839. 381 10-horsepower standard military engines and 1,422 20-horsepower. Army Mobility Equipment Command, St. Louis, Mo. DA-AK-01-70-C4163.

—**Bulova Watch Co., Inc.**, Valley Stream, N. Y. $1,292,306. Production of XM577 mechanical time fuzes. Army Picatinny Arsenal, Dover, N. J. DA AA-2170-00154.

—**Chrysler Corp.**, Centerline, Mich. $4,500,000 (contract modification). System engineering management for M60A1E2 tank. Army Weapons Command, Rock Island, Ill. DA AF03-69-C0087.

—**Thiokol Chemical Corp.**, Bristol, Pa. $2,110,221 (contract modification). Loading, assembling and packing medium and heavy caliber ammunition at Longhorn Army Ammunition Plant, Marshall, Tex. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-11-173-AMC-200 (A).

—**ITT Gilfillan, Inc.**, Van Nuys, Calif. $1,641,000. AN/TPN-18 radars and ancillary items. Army Electronics Command, Ft. Monmouth, N. J. DA AB07-69-C0277.

—**AVCO Corp.**, Stratford, Conn. $2,311,000. Production improvement for T-55-L-11 turbine engines. Army Aviation Systems Command, St. Louis, Mo. DA AJ-01-70-C0515.

—**Adventure Line Mfg. Co.**, Parsons, Kan. $1,582,624. 20-round magazine assemblies for M16 weapons family. Army Weapons Command, Rock Island, Ill. DA AF-03-70-C0042.

—**Norris Industries**, Los Angeles, Calif. $2,355,200. 81mm projectiles and metal parts. Riverbank Army Ammunition Plant, Riverbank, Calif. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA AA09-70-C0240.

DEPARTMENT OF THE NAVY

2—**Susquehannah Corp.**, Alexandria, Va. $2,433,432. Mk 30 Mod 2 rocket motors. Naval Ordnance Systems Command, Washington, D.C. N00017-68-C-2103.

—**Yardney Electric Corp.**, New York, N.Y. $1,888,320. Mk 46 Mod 1 batteries. Pawcatuck, Conn. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1404.

—**General Motors Corp.**, Hudson, Ohio. $2,450,721. Rough terrain tractors. Hq., Marine Corps, Washington, D.C. M00027-70-C-0035.

3—**Librascope Group, Singer-General Precision Corp.**, Glendale, Calif. $1,218,000. Development of the Mk 48 torpedo fire control system. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-1212.

—**Scripps Institution of Oceanography, University of California**, San Diego, Calif. $1,764,400. Research on marine physics. Office of Naval Research, Washington, D.C.

5—**Lockheed Aircraft Corp.**, Burbank, Calif. $10,000,000 (contract modification). S-3A aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0885.

—**Singer-General Precision, Inc.**, Glendale, Calif. $1,131,193. Mk 48 fire control modification kits. Naval Ordnance Systems Command, Washington, D.C. N00017-68-C-1218.

8—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

General Electric Co., West Lynn, Mass. $7,000,000. TF-34-GE-2 engines for the S-3A flight test program. N00019-69-C-0424.

Grumman Aerospace Corp., Bethpage, N.Y. $5,000,000. E-2C aircraft. N00019-68-C-0542.

9—**General Dynamics Corp.**, Groton, Conn. $6,205,000 (contract modification). Procurement, inspection, testing and shipment of long lead time materials, equipment and components required for overhaul and conversion of 12 Polaris submarines to C-3 Poseidon missiles. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0325.

—**Sperry Rand Corp.**, Salt Lake City, Utah. $7,337,551. Guidance and control components for Shrike missiles. Naval Purchasing Office, Los Angeles, Calif. N00123-69-C-2267.

—**Yuba Industries, Inc.**, Benicia, Calif. $3,580,252. Catapult system track covers. Naval Regional Procurement Office, Oakland, Calif. N66314-69-C-1015.

—**General Electric Co.**, West Lynn, Mass. $1,413,645. Retrofit kits for T-58-8/10 engines for CH-46, UH-46, SH-3D, UH-2 and VH-3 helicopters. Naval Aviation Supply Office, Philadelphia, Pa. F34601-69-A-1028-GBCF.

10—**Lockheed Aircraft Corp.**, Sunnyvale, Calif. $14,046,050 (contract modification). Phase I of the Safeguard Systems Test Target Program. Naval Strategic Systems Project Office, Washington, D. C. N00030-68-C-0303.

—**Singer-General Precison, Inc.**, Little Falls, N.J. $1,637,057. Spare parts for inertial measurement systems in A-7E aircraft. Naval Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3201-0219.

—**General Electric Co.**, Schenectady, N.Y. $1,100,000. Design and furnishing of nuclear propulsion components. Naval Ship Systems Command, Washington, D.C. N00024-69-C-5154.

11—**General Electric Co.**, Washington, D.C. $9,020,038. Operational support services for Polaris and Poseidon missile system fire control and guidance support equip-

ment. Pittsfield, Mass. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0125.

—Blake Construction Co., Inc., Washington, D.C. $2,638,000. Construction of gamma ray facility, Naval Ordnance Laboratory, White Oak, Md. Naval Facilities Engineering Command, Washington, D.C. N62477-69-C-0049.

12—The Boeing Co., Morton, Pa. $1,680,000. H-46 helicopter rotor blades. Naval Aviation Supply Office, Philadelphia, Pa. N00383-68-A-5601-1038.

15—Hughes Aircraft Co., Culver City, Calif. $8,700,000 (contract modification). Phoenix missiles. Naval Air Systems Command, Washington, D.C. N00019-67-C-0240.

—Hercules, Inc., Cumberland, Md. $1,331,024. Standard missile rocket motors. Mineral County, W. Va. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2204.

16—University of Rochester, Rochester, N.Y. $3,000,000. Additional research, studies and investigations to assist Dept. of the Navy in decisions regarding application and development of naval capabilities. Rochester and Arlington, Va. Office of Naval Research, Washington, D.C.

—Dell Industries, Waycross, Ga. $1,051,350. Mark 76, Mod 5 practice bombs. Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-A067.

17—Genge Industries, Inc., Port Hueneme, Calif. $7,250,381. Non-personal services for drafting, illustration and technical writing in support of weapon systems developments at the Naval Weapons Center, China Lake, Calif. Navy Purchasing Office, Los Angeles, Calif. N00123-70-C-0203.

—North American Rockwell Corp., Columbus, Ohio. $2,000,000 (contract modification). Long lead time effort and materials in support of procurement of OV-10A aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0606.

—IBM Corp., Gaithersburg, Md. $1,304,905. Mass storage media units for computer systems. Naval Ship Systems Command, Washington, D.C. N00024-68-C-1240.

18—Clevite Corp., Cleveland, Ohio. $5,000,000. Fabricate and procure necessary support equipment and services for preproduction prototype torpedoes MK 48, Mod 1. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-1426.

—United Aircraft Corp., Windsor Locks, Conn. $2,502,468. Propellers for C-130 aircraft. Navy Aviation Supply Office, Philadelphia, Pa. N00383-67-A-1901-1221.

—United Aircraft Corp., E. Hartford, Conn. $1,254,135. TF30P408 engine spare parts. Navy Aviation Supply Office, Philadelphia, Pa. N00383-0-6900A-AG859.

19—Westinghouse Electric Corp., Baltimore, Md. $9,974,729. FY 1970 procurement of AN/APG-59 radar sets. Naval Air Systems Command, Washington, D.C. N00019-70-C-0127.

—Sperry Rand Corp., St. Paul, Minn. $1,400,000. Production of MK 152 computers and associated ancillary equipment for Tartar and Talos fire control systems MK 74 and MK 77. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-2326.

—Garrett Corp., Phoenix, Ariz. $1,082,910. Exhaust deflection and internal containment kits for modification of GTCP100-54 and GTC85-72 gas turbine engines. Navy Aviation Supply Office, Philadelphia, Pa. N00383-67-A-2301-0809.

23—LTV Aerospace Corp., Dallas, Tex. $23,400,000 (contract modification). Procurement of FY 1970 A-7D aircraft for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-67-C-0143.

—Tracor, Inc., Austin, Tex. $2,006,844. Engineering technical tasks and studies to improve Navy submarine sonar equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1146.

—R. D. Lambert & Son, Inc., Chesapeake, Va. $1,231,344. Construction of 504-man bachelor enlisted quarters at Naval Air Station, Oceana, Virginia Beach, Va. Naval Facilities Engineering Command, Washington, D.C. N62470-69-C-0738.

—RCA Corp., Moorestown, N.J., $262,930,400. Engineering development of the Advanced Surface Missile System. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2403.

—RCA Corp., Morristown, N.J. $252,930,400. Engineering development of advanced surface missile system. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2403.

24—Honeywell, Inc., W. Covina, Calif. $5,420,969. Basic sonar operator trainers with data and support ware and option for three additional units. Naval Training Device Center, Orlando, Fla. N61339-70-C-0078.

—LTV Aerospace Corp., Dallas, Tex. $2,027,836. Spare parts to support armament station control unit on A-7E aircraft. Navy Aviation Supply Office, Philadelphia, Pa. N00383-69-A-4201-1093.

—LTV Aerospace Corp., Dallas, Tex. $1,840,299. Spare parts for A-7E aircraft. Navy Aviation Supply Office, Philadelphia, Pa. N00383-69-A-4201-1094.

—Pioneer Recovery Systems, Inc., Manchester, Conn. $1,567,680. Parachute and container assemblies used in MK45 flare. Columbia, Miss. Naval Ammunition Depot, Crane, Ind.

29—Fishback & Moore, Inc., Dallas, Tex. $1,535,421. Special electronic system including VHF-UHF antenna, associated data, repair parts and training manuals. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1181.

—Grumman Aerospace Corp., Bethpage, N.Y. $38,250,013. A-6A aircraft. Bethpage and Calverton, N.Y. Naval Air Systems Command, Washington, D.C. N00019-69-C-0075.

—Sperry Gyroscope Co., Great Neck, N.Y. $2,443,000. Production of computers MK 119, Mod. 0 and Mod. 5. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-2325.

30—Sangamo Electric Co., Springfield, Ill. $1,985,430. Sonar classification trainer units. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1136.

DEPARTMENT OF THE AIR FORCE

1—Chicago Aerial Industries, Inc., Barrington, Ill. $1,133,138. Aerial photographic equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1085.

2—AVCO Corp., New York, N.Y. $1,200,000. Research and development of penetration aids. Wilmington, Mass. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-68-C-0021.

3—Radiation, Inc., Melbourne, Fla. $4,912,000. Development and production of airborne communications equipment. Palm Bay, Fla. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-69-C-0159.

—Martin Marietta Corp., Denver, Colo. $1,081,000. Design, develop and fabricate Titan IIIC space boosters and associated ground support equipment. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04695-67-C-0142.

—Philco-Ford Corp., Philadelphia, Pa. $44,375,075. Engineering, furnishing, installing and testing an aircraft control and warning system. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-1573.

—Saunders Associates, Inc., Nashua, N. H. $1,147,500. Production of ground communications equipment. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-67-C-0139.

4—Cutler-Hammer, Inc., Deer Park, N.Y. $1,114,000. Engineering services on airborne reconnaissance systems. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-0897.

9—North American Rockwell Corp., Anaheim, Calif. $122,320,000. Guidance and control systems for Minuteman III missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0194.

10—General Electric Co., New York, N.Y. $26,438,265 and $11,535,944. J-79 engines, spare parts and aerospace ground equipment. Cincinnati, Ohio. F33657-69-C-1285 and F33657-69-C-1080. $13,380,000. J-85 series engines and related spare parts. West Lynn, Mass. F33657-70-C-0229. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio.

—Ryan Aeronautical Co., San Diego, Calif. $4,547,993. Target drones, spare parts and special support equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB. Ohio. F33657-70-C-0027.

—ITT Corp., Nutley, N.J. $1,000,000. Modification and testing of electronic equipment. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-70-C-0276.

12—McDonnell Douglas Corp., St. Louis, Mo. $1,151,100. Modification of RF-4C aircraft. Robertson, Mo. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F3460-68-A-2019.

—General Electric Co., Philadelphia, Pa. $5,333,250. Research and development of the Mk 12 reentry vehicle. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF04(694)-473.

—Lockheed Aircraft Corp., Marietta, Ga. $6,757,260. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF(657)-15053.

—Stewart-Warner Corp., Chicago, Ill. $1,552,468. Radar components for AN/APN-159 altimeter sets for RF-4 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0433.

—Singer Co., Arcadia, Calif. $10,900,667. Ejector racks, MER-10NN and TER-9A for F-4E and A-7D aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-3900.

15—Sylvania Electronics Systems, Waltham, Mass. $10,240,000. Design and redevelopment of the Minuteman command and control system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0192.

16—Lockheed Aircraft Corp., Burbank, Calif. $4,964,000. Services and material to accomplish inspection, modification and repair as necessary of F/TF-104G aircraft. Palmdale, Calif. Sacramento AMA, McClellan AFB, Calif. F40606-70-C-0186.

17—Brooks & Perkins, Inc., Detroit, Mich. $2,066,610. Large cargo pallets for military aircraft. Cadillac, Mich. Warner Robins AMA, Robins AFB, Ga. F09603-69-A-0039.

19—Texas Instruments, Inc., Dallas, Tex. $1,030,000. Aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-68-C-0379.

—North American Rockwell Corp., Anaheim, Calif. $1,187,000. B-1 avionics subsystem studies. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0670.

—Lockheed Aircraft Corp., Marietta, Ga. $1,217,331. C-5 depot aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio.

—General Dynamics Corp., Fort Worth, Tex. $1,228,780. Spare parts for F-111 aircraft. Sacramento AMA, AFLC, McClellan AFB, Calif. AF33(657)-13403.

—IBM Corp., Owego, N.Y. $972,736. B-1 avionics subsystem studies. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0671.

22—Radiation, Inc. Melbourne, Fla. $1,709,000. Operation and maintenance of airborne communications equipment. Palm Bay, Fla. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-70-C-0004.

—Olin Mathieson Chemical Corp., E. Alton, Ill. $1,273,204. Aircraft engine starter cartridges. Marion, Ill. Ogden AMA, AFLC, Hill AFB, Utah. F42600-70-C-0719.

—McDonnell Douglas Corp., Tulsa, Okla. $1,143,049. Inspection and repair as necessary of B-66 series aircraft. Warner

obins AMA, AFLC, Robins AFB, Ga. -09603-70-C-1017.

endix Corp., Teterboro, N.J. $3,344,481. roduction of electronic components ap- icable to Minuteman III system. Space id Missile Systems Organization, AFSC, os Angeles, Calif. F04701-69-C-0233.

oneywell, Inc., Hopkins, Minn. $2,000,000 upplemental agreement). Production of spensers and mines. St. Louis Park, inn. Armament Development and Test enter, AFSC, Eglin AFB, Fla. AF33 57)-16858.

eneral Motors Corp., Indianapolis, Ind. 3,055,424. Production of TF-41-A-1 tur- fan engines. Aeronautical Systems Di- sion, AFSC, Wright-Patterson AFB, hio. F33657-67-C-0163.

ollsman Instrument Corp., Elmhurst, .Y. $2,426,220. Production of altimeters r various types of aircraft. Aeronau- al Systems Division, AFSC, Wright- atterson AFB, Ohio. F33657-68-C-0569.

orth American Rockwell Corp., Anaheim, alif. $6,441,000. Production of Minutemen I guidance and control systems. Space d Missile Systems Organization, AFSC, orton AFB, Calif. F04701-68-C-0174.

echnicolor, Inc., Hollywood, Calif. $3,- 6,861. Photo optical instrumentation and ated support services at Air Force stern Test Range, Kennedy Space Cen- , Fla. Range Contract Management fice, Air Force Eastern Test Range, FSC, Patrick AFB, Fla. F08606-69-C- 08.

oneywell, Inc., Hopkins, Minn. $3,487,- 2. Munitions production. Armament velopment & Test Center, AFSC, Eglin FB, Fla. F08635-69-C-0016.

ilco-Ford Corp., Palo Alto, Calif. $1,- 1,100. Production of electronic display uipment. Space and Missile Systems ganization, AFSC, Los Angeles, Calif. 4701-70-C-0015.

nium Structures lied for Air Force

tudy of high pay-off uses of dif- bonded titanium structures in ced airframes for aircraft is conducted for the Air Force Dynamics Laboratory by Mc- ll Douglas Corp., St. Louis, Mo. nnell will also prepare a detailed is of selected structural compo- to determine additional cost and t benefits of diffusion bonded ti- compared to conventional tita- design.

ective of the study is to deter- ow competitive airframe struc- made of diffusion bonded tita- would be compared to titanium hardware produced by conven- manufacturing processes. titiveness of titanium struc- will be established for the pre- me and projected for time per- 1975 and 1980.

study is expected to be con- by mid-1970. Charles Ramsey ect engineer in diffusion bonded m structures at the Air Force Dynamics Laboratory, Wright- son AFB, Ohio.

F-15 Prime Contractor Selected by Air Force

With the approval of the Secretary of Defense, the Air Force has selected McDonnell Douglas Corp., St. Louis, Mo., as prime contractor for development and production of the F-15 advanced tactical fighter aircraft. The F-15 will be a single-place, twin-engine jet fighter with performance over a broad range of altitudes and speeds. It will carry both missile and gun armament needed for typical tactical missions of fighter sweep, escort and combat air patrol.

The contract awarded to McDonnell Douglas will use cost-plus-incentive-fee features for the engineering and design effort, and fixed-price-plus-incentive-fee for the test aircraft, initial production effort, and subsequent production option quantities. Demonstrable technical milestones, which the contractor must meet to the satisfaction of the Government prior to an authorization to proceed with production, are incorporated in the award.

The airframe contractor will initially proceed only with the engineering and design effort and the fabrication of 20 development testing aircraft, at a target price of $1,146,385,000. This includes spares and equipment to support the test program. The first increment to be funded for this contract is $80,240,000. An additional contract will be negotiated in March with the successful propulsion bidder, after completion of current competition for the engine between the General Electric Co. and Pratt and Whitney Co.

Initial funds required by these contracts have already been approved by Congress in the FY 1970 budget. Future funding for the entire F-15 development and production effort is subject to annual Congressional review and approval. Subsequent production of the first wing of 107 aircraft is subject to a "not-to-exceed" ceiling of $936,591,000. This amount includes maintenance training, associated training equipment, and technical data. Since the proposed F-15 engines are still under evaluation, engine costs are not included in the foregoing figure.

The prime contractor estimates that approximately 4,000 subcontractors, located in 42 states, will be participating in the F-15 program.

Brigadier General Benjamin N. Bellis of the Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson AFB, Ohio, has been designated System Program Director for the F-15.

New Missile Defense System for Ships Contracted by Navy

The Navy has awarded a contract in the amount of $252,930,400 to RCA Defense Electronics Products Division for the engineering development of its new advanced surface missile system. Known as Aegis, it is planned as the defensive surface-to-air missile system for the new guided missile ships scheduled to join the Fleet in the mid-1970s. The system is designed to destroy small, fast targets in hostile environments such as severe weather or countermeasure conditions.

Two special features of the system are an electronic scanning radar able to "look" in all directions almost instantaneously, and a dual-purpose launcher which can fire rocket-propelled antisubmarine weapons, as well as guided antiaircraft missiles. The Aegis radar and related subsystems can aid in controlling friendly aircraft, as well as locating hostile air targets for surface-to-air missiles.

Additional components of Aegis will include a newly designed data system computer and illuminators for missile guidance. The illuminator "bounces" a radar signal off the target. The missile picks up the signal and rides it to the target.

The contractor will use extensive subcontracting nationwide for materials, parts and components.

The Aegis program is part of the Surface Missile System Project of the Naval Ordnance Systems Command, Naval Material Command (NAVMAT). In addition, technical support and assistance is provided by the NAVMAT Naval Ship Systems Command. Project Manager is Captain Merrill H. Sappington, USN, whose field of responsibility also includes Terrier, Tartar, Talos and Standard missiles. Program Manager is Captain John P. Tazewell, USN.

Defense Industry Bulletin
Defense Supply Agency
Cameron Station, Alexandria, Va. 22314

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Air Force Tests Instant Control Tower for Tactical Operations

A tactical air traffic control central, which can convert an unattended airstrip into a "high-capacity military airfield" within one hour, is undergoing testing at the Air Force Armament Development and Test Center, Eglin AFB, Fla. Designated AN/TSW–7, the unit is part of the overall 407L Tactical Air Control System, a program managed by the Air Force Systems Command's Electronic Systems Division, L. G. Hanscom Field, Mass.

This lightweight control tower is equipped with all the communications and navigational aids needed to visually control everything from jet fighters and transports to small reconnaissance aircraft. Sometime referred to as an "instant airport," TSW–7 is designed to operate in any climate zone from tropic jungle to arctic cold. It is equipped with an air conditioner-heating unit mounted on a separate equipment pallet. Also located on the same pallet is a rechargeable battery and small charging generator which can operate the system for a short period, in case of power failure from land cables or mobile generators.

Measuring only 12 by 7 by 7½ feet, the tower shelter can accommodate three air traffic controllers. It has four Very High Frequency (VHF) and five Ultra High Frequency (UHF) transmitter-receiver radios. Additional equipments include a radio direction finder, wind speed and direction sensors, telephone and direct line communications, and two signal light guns. Additional space in the tower is provided to mount one High Frequency (HF) and two more UHF transceivers.

Advanced design features in the TSW–7 include a specially designed single-mast antenna system, solid state radios and a highly accurate radio direction finder.

In addition to its instant air base capability, the tower can substitute for fixed air traffic control towers which have been destroyed or temporarily put out of commission.

New Camouflage Proposed by Army

The Army is seeking new ways not to be seen. Under a new proposal by the Combat Developments Command (CDC), Fort Belvoir, Va., new lightweight camouflage screens will replace contemporary burlap-garnished cotton twine nets.

According to CDC, the new screen would be lighter and easier to handle.

Conventional nets had to be produced in various families of sizes, shapes and color blends to meet general as well as specific requirements, creating a logistical burden.

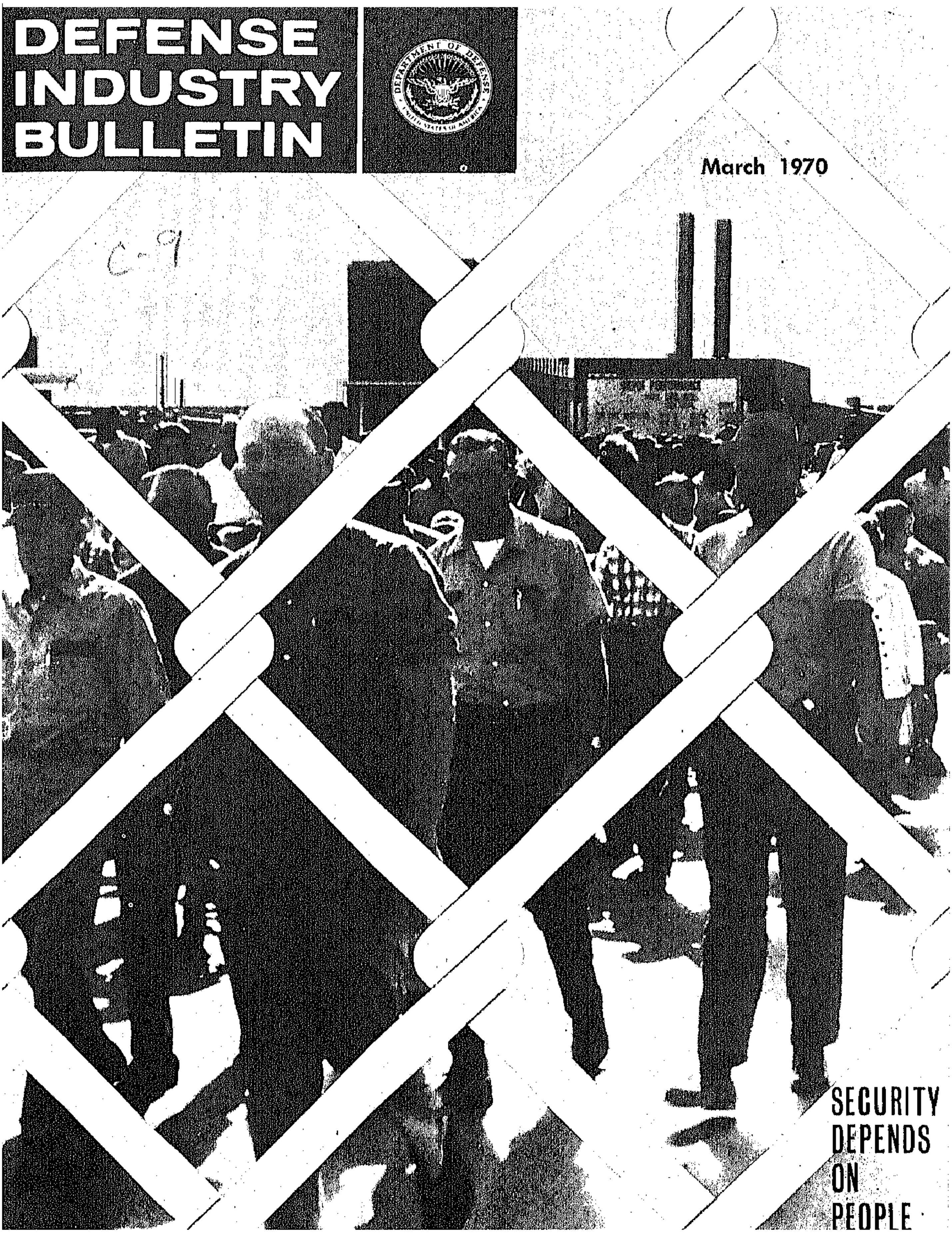
The new screen would be made of synthetic materials. One screen would provide 400 square feet of area concealment, erected in a domed configuration. Joined at the edges, two or more screens could be used to conceal larger objects.

Initial requirements call for the new system to offer three reversible designs: woodlands, desert and snow.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1970 393-618/7

DEFENSE INDUSTRY BULLETIN

March 1970



SECURITY DEPENDS ON PEOPLE

DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 3 **March 1970**

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency (DSAH-B), Alexandria, Va. 22314.

IN THIS ISSUE

FEATURES

DEPARTMENTS

DOD security policy is designed to safeguard against adversity to the overall security of the United States. It affects millions of people. Industry shares with Government a responsibility to provide the required security. Security policy can be fully effective only if personnel involved are aware of their security responsibilities. A broad review of DOD security policy begins on page 1.

Dynamic Security Policy Serves National Interest

Joseph J. Liebling

It should prove useful and hopefully interesting, early in this new year and new decade, to review the security policy of the Defense Department, as it has developed and now exists. DOD security policy is designed mainly to safeguard against adversity to the overall security of the United States and its relationship to allied governments.

The fact that there is DOD security policy, that it affects millions of people, not only in the United States, but in other countries, and that sound security policy is vital to the security of our nation may be news to some readers. It is current and common knowledge to a relatively small group of people, directly involved in the day-to-day development and application of that policy.

This broad review of DOD security policy is intended for those individuals who only occasionally may come upon, or be directly affected by, some aspect of the policy. Managers, engineers, salesmen, scientists, and others in industry, who must function and produce in the face of what may seem to them to be irrelevant, restrictive and, sometimes, confusing security requirements, will benefit from additional information on this all-important subject. Knowledge begets confidence and enlightened responsiveness. Good, practical security can only be attained through enlightened understanding by each individual involved, because the national security places a responsibility on individuals and organizations, both in Government and in industry, to assure that the required safeguards are established and maintained. Under our system, where the national interest and requirements are melded and refined into proper security policy guidance, industry shares with Government a responsibility to provide the required security.

DOD security policy meets and interprets national considerations and requirements head-on, whether they are established in and by the Constitution, in public laws enacted by the Congress, or by Presidential executive order. New laws that are enacted, policy announcements or executive orders issued by the President, and court decisions are prime guidance sources for the development and implementation of DOD security policy. It is mandatory that DOD security policy legislation and planning include due and careful consideration of the expressed views and requirements of many segments of the Government, as well as all elements of DOD including the Military Departments, the Defense Agencies, and the field command operations.

Where policy is applicable to industry, careful consideration of the expressed views and suggestions of industry, through appropriately recognized industrial security professionals and their trade associations, must be

Joseph J. Liebling is Director for Security Policy, Office of the Assistant Secretary of Defense (Administration). He was recipient of the 1969 National Civil Service League Award as "one of the ten outstanding career men in the U.S. Government."

Legal Bases of Security Policy

Congress, through authority vested in it by the Constitution, has enacted a number of laws which relate to the security policy and programs of the Defense Department. In response to and in conformance with these laws, security policy has been developed both internally to DOD, and externally in relation to other segments of the Executive and Legislative Branches of the Government, U.S. industry, international organizations, foreign governments, and the public. Statutory bases for the DOD security program include the Espionage and Sabotage Acts (Title 18, U.S. Code) ; the Internal Security Act of 1950, Public Law 733, 81st Congress; the National Security Act of 1947, as amended; and the "Housekeeping Statute" (5th U.S.C. 301).

The President, through authority vested in him by the Constitution, acting in his capacity as the Chief Executive and Commander-in-Chief of the Armed Forces, has issued executive orders, amended from time to time, which impose security responsibilities on the Secretaries of the Departments, and Heads of other Executive Branch Agencies. These include: Executive Order 10501, "Safeguarding Official Information in the Interests of the Defense of the United States;" Executive Order 10450, "Security Requirements for Civilian Employment;" Executive Order 10865, "Safeguarding Classified Information Within Industry;" and Executive Order 10421, "Providing for the Physical Security of Facilities Important to the National Defense."

assured. The national interest would be sparsely served if the national level policy sources, untreated in carefully developed security policy pronouncement, were left in their original and usually general terms to serve as guidance. We have, then, the national interest supported by DOD security policy, which is the umbrella covering eight broad security programs. These are discussed to some degree in this article. Several of these programs will be given more detailed treatment in later articles.

Before consideration may properly be given to these eight broad security program areas, an understanding of the relationship, one to the other, is necessary. These eight have been established because many subprograms within each are homogeneous, and to provide uniformity in their accomplishment. Each program is not sharply isolated, one from the other as an autonomous entity, but rather each is a part of the total security mosaic, mutually interdependent and supporting. The programs are:

- Personnel Security.
- Industrial.
- Investigative Management.
- International.
- Administrative and Physical Security.
- Security Support and Planning.
- Security Training.
- Classification Management.

Personnel Security Program

In any security system that is to be established, a basic consideration must be the trustworthiness of the people to be involved in its accomplishment. This precept is borne out by Presidential executive order which requires, for example, that persons, who are to be afforded access to classified information, must be determined to be trustworthy.

To fulfill this national requirement, and others involving personnel utilization and assignment, DOD directives establish subprograms covering military personnel, civilian applicants and employees, personnel security involving nuclear duties, and personnel security in special agencies.

ndustrial Program

Industrial Security and Industrial)efense are subprograms in this road security program area. The Deense Industrial Security Program DISP) affects an appreciably large ross section of the nation. It involves hose industries entering into contrac-.ıal relationships with the Governıent in which classified information ; involved in the performance of the ontracts. There are approximately 3,500 cleared industrial facilities presntly involved in the DISP, and these ave approximately 2.2 million indus-rial employees cleared for access to lassified information.

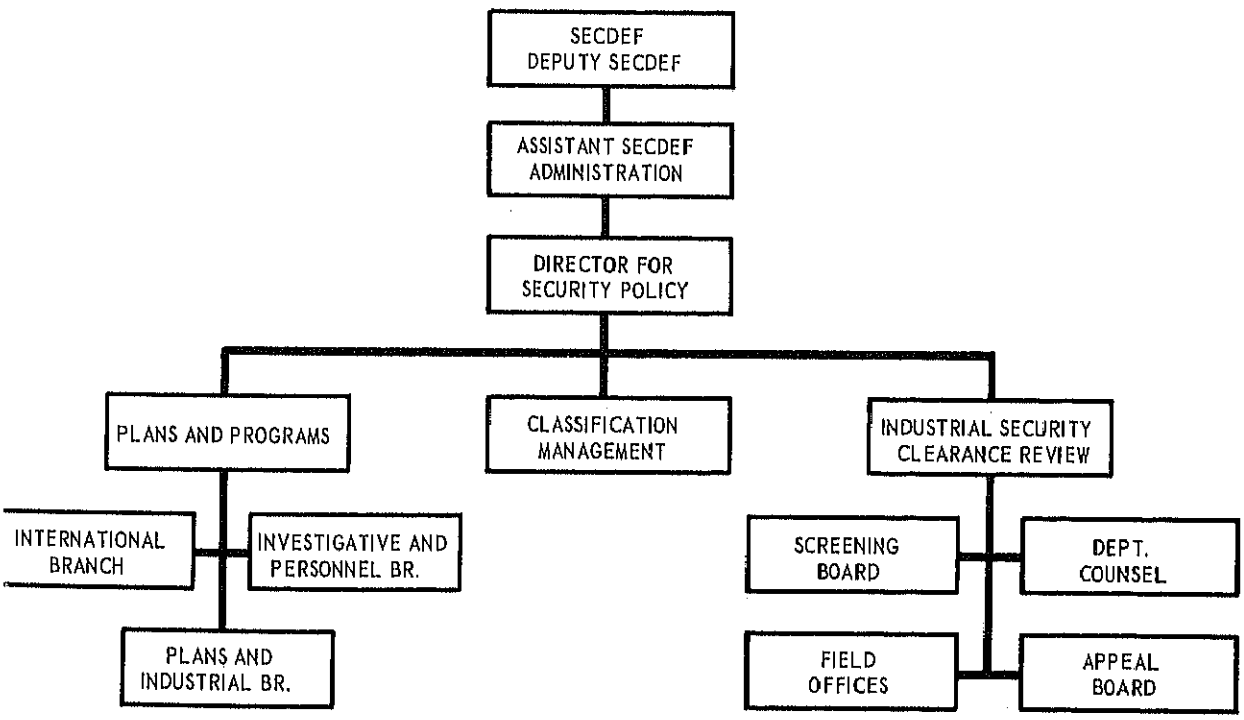
The Defense Department adminis-ers the DISP for components of DOD Military Departments and Defense .gencies) and for 11 other agencies f the Executive Branch of the Govrnment. Classified documentation lone runs into the tens of millions. Security clearances of industrial facilities and their employees are functionally included in the Industrial Security Program. Issuance of the vast majority of the industrial security clearances is handled at the Defense Industrial Security Clearance Office (DISCO), Columbus, Ohio. The final security clearance review and decision process is accomplished by the Industrial Security Clearance Review Division, Office of the Assistant Secretary of Defense (Administration), in those relatively few cases where issuance of a clearance by DISCO cannot be readily determined to be clearly in the national interest.

The Industrial Defense Program is a highly selective program involving about 3,500 industrial facilities, whose continued existence and viability are considered vital to the national defense from a direct military support aspect. Industrial defense policy follows the principle of "security in depth," meaning that physical security measures are used at the plant perimeter to prevent unauthorized persons access to the most critical and vulnerable areas therein. This principle is established mainly to reduce the probability of the successful accomplishment of the most damaging acts of sabotage.

Investigative Management

The Personnel Security Program directly depends upon information that is furnished by persons whose security eligibility must be determined, and upon information determined from other sources by the investigative elements of the Federal Government. Whatever the source, the information must be checked, verified and assembled. The security function accomplished under this program has a highly significant impact on the lives and careers of individuals throughout Government and industry. It is in the national interest, therefore, that

ORGANIZATION



investigative techniques, standards and criteria be clearly established and closely controlled. It is within this broad program area that the Background (Full Field) Investigation is established and defined, as is the National Agency Check.

The term "management" is included in this broad program title because of the sensitivity of investigations which affect the determination of the eligibility of personnel for access to classified information in the national interest. Management responsibility is clearly mandated, also, because substantial resources are used in accomplishing the objectives, and because these investigations and the utilization of the resulting information must be accomplished without infringement upon the basic rights of the individuals. These vital conditions must be met. There must be clear, balanced judgment of the national security and constitutional rights of people.

International Program

The Director for Security Policy of the Office of the Assistant Secretary of Defense (Administration) acts for the Secretary of Defense in his role as U.S. Security Authority to NATO, SEATO and CENTO; and for the Assistant Secretary of Defense (Administration) with respect to international organizations and individual countries in developing overall security policies; negotiating security agreements; and developing the U.S. security position, in collaboration with the Department of State, for expression to those organizations and countries.

Security agreements are drafted and negotiated with the defense agencies of foreign governments for the protection of classified information disclosed to those nations, and incidental to classified work undertaken by industry in either country. Special agreements, for the protection of classified information and material incidental to the sale of U.S. weapons and weapon systems, are also drafted and negotiated whenever they are needed. U.S. security policy standards and procedures are often adopted by the foreign countries. It is not unusual that each country agrees to protect the classified information of the other country to the degree that it protects its own information.

Administrative, Physical Security

This is an extensive program concerned with all physical safeguards and administrative procedures designed to protect defense information. Included in this program are special security requirements concerning re-

PROGRAMS AND

PERSONNEL SECURITY	INDUSTRIAL PROGRAMS	INVESTIGATIVE MANAGEMENT	ADMINISTRATIVE & PHYSICAL SECURITY
5210.9 Military Program	5220.6 Clearance Adjudication	5200.24 Interception & Eavesdropping	3224.3 Security Equipment
5210.31 Uniform Guidelines	5220.22 Industrial Security Program	5210.8 Investigation & Clearance	5200.1 Safeguarding Information
5210.42 Reliability in Nuclear Duties	5220.22–M Industrial Security Manual	5210.48 Polygraph	5200.8 Commanders' Post Authority
5210.45 National Security Agency	5220.22–R Industrial Security Regulation	7730.32 Reporting Requirements	5200.15 Dissemination of Intelligence
5210.7 Civilian Program	5220.22–S Crypto Supplement	4640.1 Telephone Monitoring	5210.2 Dissemination of Restricted Data
5210.25 5210.26 Red Cross Program	5160.54 Industrial Defense	5200.25 AJCC Counter-Intelligence Program	5210.41 Safeguarding Atomic Weapons

stricted data and nuclear weapons, special security policy guidance for research and development, and the testing and evaluation of physical security equipment.

Security Support and Planning

National security policy is developed in many broad areas under this program. It encompasses several subprograms that are related both to daily operations and to planning for future policy requirements and operations.

A significant mechanism for action under this program is the Interdepartment Committee on Internal Security (ICIS), composed of representatives of the Departments of State, Treasury, Defense, and Justice, whose chairman is appointed by the President from the membership. Within this program area also is the emergency planning conducted in conjunction with the Office of Emergency Preparedness.

Security Training

Security policy, and the procedures to assure that security practices are in conformance with that policy, can be fully effective only if the personnel involved are aware of their security responsibilities, are aware of the reasons why certain procedures must be carried out and, further, are motivated to carry them out. The attainment of this all-important attitude is the objective of the Security Training Program.

The full meaning of this precept can be elusive, unless the reputation that certain aspects of security has regrettably carried through the years—the fear syndrome—is remembered. While it is true that security clearances are suspended and revoked for cause, especially in flagrant and in repetitive security violations cases, the policy is to attain the desired security condition through quality education and training.

Classification Management

The Security Classification Management Program is concerned with six classification aspects of information. They are:

- Levels of classification: Top Secret, Secret and Confidential.
- Authority to classify information.
- Principles applicable to classification.
- Declassification and change of classification.
- Marking of classified documents.

DOD DIRECTIVES

CLASSIFICATION MANAGEMENT

5120.33 Classification Management Program

5120.34 Implementation of Program

5200.9 Declassification Before 1/1/46

5200.10 Downgrading and Declassification

5210.47 Classification of Information

5210.39, 5210.49, 5210.51, 5210.52, 5210.53 Project Classification Guidance

SECURITY SUPPORT AND PLANNING

TS-3000.1 Emergency Apprehension & Detention

3115.1 Internal Security

5030.34 Secret Service Agreement

5200.12 Scientific and Technical Meetings

5230.7 Censorship Planning

INTERNATIONAL SECURITY

5100.55 USSA for NATO, CENTO, SEATO

C-5210.21 NATO Regulation

C-5210.35 CENTO Regulation

5210.54 SEATO Regulation

SECURITY TRAINING

5200.14 Briefings

5210.43 Termination & Debriefing

5210.44 Orientation, Education, and Training

• Review of the appropriateness of classification.

In its broader context, this program precedes all of the others that have been discussed, because few other security actions would be needed if information did not require special handling and protection. Because it is in the vanguard of much of the security policy and requirements that we have today, lack of top-notch classification management at any level of Government or industry has far-reaching and undesirable effects. These effects detract from the desired security condition because of improper classification (or no classification); and because the effort and resources, in terms of costs, manpower and other administrative security measures expended to provide security, could be misdirected when information has not been properly identified and classified. It is most likely that this program will receive a heavier concentration of effort toward progressive declassification, consistent with security, then ever before. Total secrecy is incongruous with a democratic form of government. National security and the defense of the United States, however, does dictate the establishment of sensible rules and policies after intelligent evaluation of the threat and technological advancement worldwide.

DOD security policy can only be effectively applied through concentrated management and planning. In its more common use, the term "management" means the judicious use of available resources to meet designated objectives. For the purposes of this light summary discussion of this introduction to DOD security policy, the term "management" means assuring that policy is developed in an orderly fashion and, as published, is properly carried out.

A hasty conclusion would be: all that is required to assure conformance to policy is a rigid check and balance system. Not so. It is true, policy requires procedural conformance and that basic concepts and standards are met, but the rightness (sound legal and moral bases) of that policy is the prime mover for consistency in its application. Throughout the security programs, for example, due process of law is to be provided whenever the security clearance of an individual is to be denied or revoked for cause, while simultaneously protecting the national interest. This is the national policy, and it is DOD security policy.

To assure validity of security policy, the individual, again, is the key catalyst and administrator. As was previously mentioned, the development of policy is painstaking and meticulous. Many individuals, either directly or through organizational points of contact, are involved in the developmental stages. If their experience and local requirements and conditions are to be considered, the individuals must be provided the opportunity to be heard. In the case of industry, the Council of Defense and Space Industry Association, as well as individuals, actively participate in policy development efforts.

Because DOD security policy is national and international in scope, it must be dynamic, subject to change, alteration and adjustment and, at the same time, remain valid and effective. In recent years it has been more responsive than ever before to national security interests such as foreign policy, economic, military, labor, Congressional and the general public.

Throughout the security programs have been woven, through the establishment of policy guidance, a consistency that engenders instinctive and appropriate security action and judgment, if specific scripture and doctrine has not been produced. "Classification consistent with the importance of the information," the "need to know," "security in depth" are examples of policy concepts that have remained consistent through the years. Predictability, through sound policy, if properly expressed, is important to the total national security effort.

And finally, programs supporting security policy must be reasonable. A total security condition would stifle the nation if its defense effort could not be accomplished. Operations, manufacturing, progress, development and growth would be brought to a standstill, if security requirements were one sided and did not take into consideration the practical application thereof in Government and industry. Security must remain in its role, with sound management, initiatives and new incentives to assure that the attainable and proper condition is established and that national objectives are attained because it is appropriate and effective.

Radio Sets Tested for Digital Data Transmission Ability

Can today's military radios, many of which were developed for voice and teletypewriter transmission, handle the almost lightning speed of digital data transmission? To answer this question, the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., has developed the Mobile Digital Data Transmission Test Facility. The purpose of the new facility is to evaluate operation of Army radio sets under high-speed digital data transmission loads.

The Mobile Digital Data Transmission Test Facility is designed around a computer. A prepared message is sent through the radio set under test and received by the computer which, then, matches the received message with an exact copy of the original. As it scans the incoming message and compares it with the original, the computer adds up the errors and computes the mean error rate. Thus, at the end of the test, engineers have a printout of the test results and can decide whether or not the radio set is capable of handling high-speed transmission.

Tests on present radio sets will determine which are suitable for high-speed transmission methods. Results may lead to the development of future radio sets capable of the precision required for digital data.

The new test facility is housed in two mobile shelters and can be moved to any site required. The computer and receiving equipment are in a trailer van, and the transmitting equipment is installed in a truck-mounted shelter.

Automation— Force Effectiveness Multiplier

Brigadier General Wilson R. Reed, USA

Data systems are like weapon systems, only more so.

A system is far more than a mere complex of intricate equipment: It is a combination of machines, methods and men, organized to accomplish a mission.

The Army, which incubated the Electronic Numerical Integrator and Calculator (ENIAC) during World War II and, thus, introduced electronic digital computer technology to the world, came to an early understanding of this dictum, and is applying its understanding vigorously.

In March 1969, the Chief of Staff of the Army established the U.S. Army Computer Systems Command (CSC) and assigned to the command a scope of responsibility and a range of automatic data processing (ADP) action areas, that are broader than any ever before assigned to a single line command in the defense establishment. The Computer Systems Command is responsible for centralized data systems development, integration, and support of all multi-command automatic data processing systems. Its charter establishes the CSC commanding general as project manager over ADP systems for combat, combat support, and combat service support in a tactical environment, as well as over the entire spectrum of administrative systems which are required both within the continental United States and overseas, but which can operate within a conventional fixed-station installation. The command is, therefore, the central systems design and management agency for systems calling for development of new vehicle-mounted, militarized data processing equipment, and for systems using the same commercial computer equipment used by industry, universities and Government for the full range of scientific, management and process control systems.

The command is located within the Army and is internally structured to play a central role in the development of all four system components (mission, men, machines, methods). The command is dedicated to the principle that men and mission are by far the most important system components.

Mission

System missions are defined by the top functional managers of the Army, by each of the Deputy and Assistant Chiefs of Staff, and by other agency heads of Headquarters, Department of the Army. To assure the proper interplay and collaboration between management need and technical response, the Computer Systems Command reports directly to the Army's Assistant Vice Chief of Staff, who

Brigadier General Wilson R. Reed, USA, is the first commander of the U.S. Army Computer Systems Command. He was formerly Commander, Automatic Data Field Systems Command. A graduate of the U.S. Military Academy, West Point, he also holds a Master of Arts in International Relations from Georgetown University, Washington, D.C.

maintains an Army Management Information Systems Master Plan. This plan establishes priorities within which all of the Department of the Army functional staff works to develop its management systems requirements. The Computer Systems Command works closely with these agencies to assure that these management requirements evolve into a system mission statement, which takes full advantage of the advancing technology and which is fully understood by the system designers.

The Computer Systems Command is a worldwide organization, but its headquarters is located at Fort Belvoir, Va. Fort Belvoir is not only close to the offices of the Army's top managers in the Pentagon, but is also the location of Headquarters, Army Combat Developments Command. Thus, for all tactical systems and, especially, for combat and combat support systems, mission definition is greatly enhanced by the intimate collaborations between the personnel of these two commands.

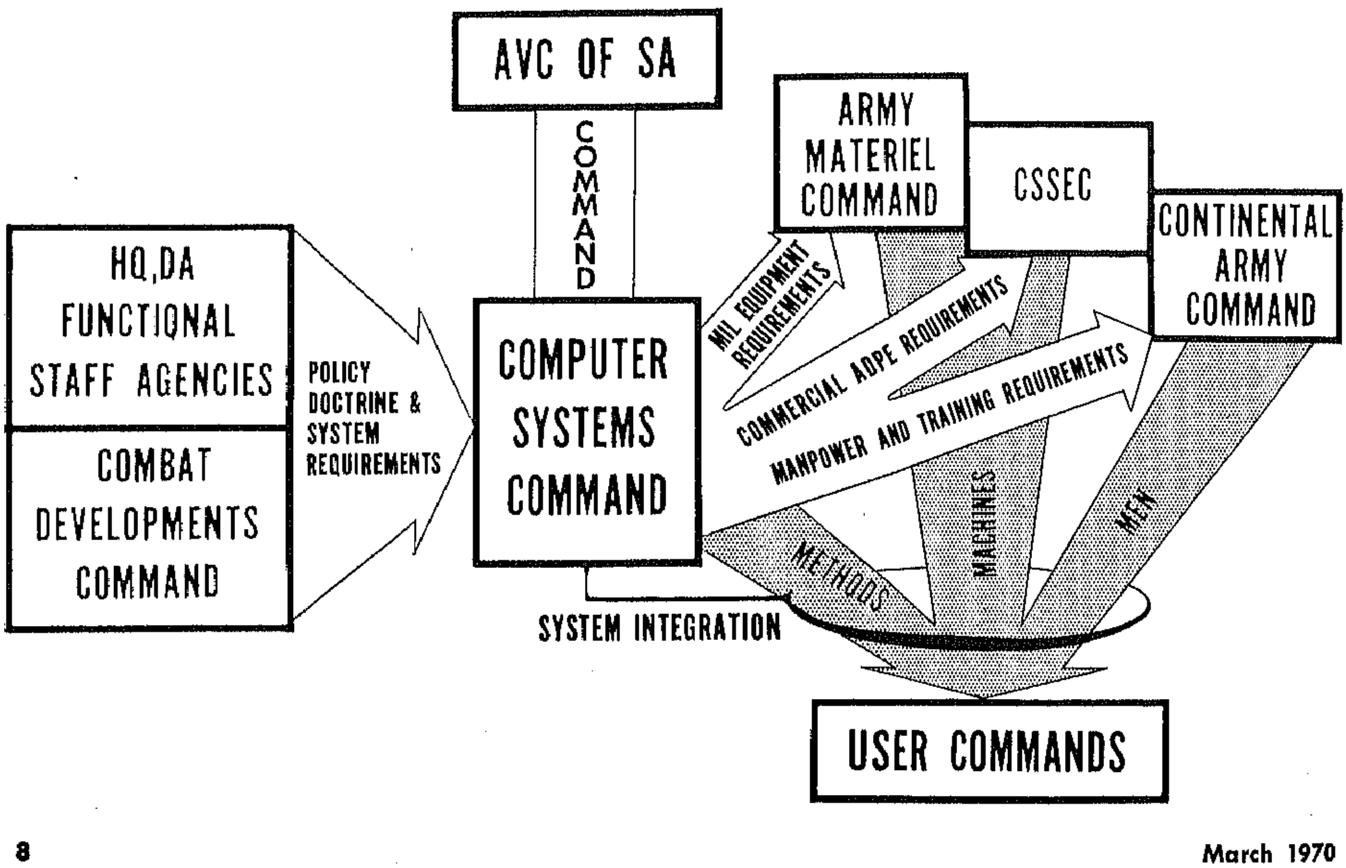
Machines

System design is based solidly on system mission definition, and the design phase is characterized by continuous dialog between designers, managers, and combat doctrine specialists. Hardware-software tradeoff analysis is performed when system design has progressed to the point that machine requirements and computer programming requirements can be specified separately. Acquisition of machines is accomplished with the participation of two other Army agencies.

Materiel development is the responsibility of the Army Materiel Command, whose headquarters is also within a short drive of Fort Belvoir. Whenever new ADP equipment development is necessary, either to meet militarization requirements or to advance the state of the art beyond the off-the-shelf stage, the Army Materiel Command performs the equipment acquisition. When commercial equipment is required, the Army Computer Systems Support and Evaluation Command at nearby Fort Myer, Va., makes the equipment selection. Both of these commands work in response to equipment specifications set by the Computer Systems Command, and all procurement is executed through Army Materiel Command procurement offices.

Methods

The methods component of each data system combines the manual methods for system operators and



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ise the knitting together of these elements into an operational system, and deliver the system to the ultimate customer, the field commander. Command personnel help the field commander to convert from his earlier procedures to the new system. A worldwide network of support groups and field assistance teams continue to provide field engineering support for the entire useful life of the system, calling upon CSC headquarters design personnel who hold their toothbrushes at the ready-to-go-anywhere-in-the-world posture if a sufficiently serious design problem calls for it.

Operation of the delivered system is turned over entirely to the field commander. It is his system, and its men and machines belong to him. Methods are updated by the Computer Systems Command when design improvements are required, or when top Army management modifies the mission statement for the system.

CSC Organization

Though the Computer Systems Command derives much benefit from its relationships with the many other agencies, both within and outside the Army, the projected growth of the command will provide self-sufficiency in all aspects of data systems technology.

Special emphasis is placed upon the CSC Scientific and Management Advisory Committee, a specialized version of the Army Scientific Advisory Panel, devoted to all aspects of research and development in computer technology and information science. Convened and coordinated by the CSC Chief Scientist, within the Office of the Commanding General, the committee has a membership of data systems authorities of national reputation. The committee includes scientists from industry, Government, and academic institutions whose specialties range from systems architecture to equipment production, and the management of data and information systems.

The CSC mission is divided between two major organizational units, headed by a Deputy for Systems Management and a Deputy for Technical Management.

Deputy for Systems Management

Operating under a project manager's charter, issued by the Secretary of the Army, the Computer Systems Command implements the principles of project management with an organizational structure which designates a system director or system manager for each data system assigned to the command. Each systems management office serves as the coordinating agency for the execution of all actions in the life-cycle management of a system and, as such, works as a central clearing house on all systems developed and released by the command for field use.

System management offices are located within the Project Control and Integration Directorate, and are organized into divisions according to echelon levels serviced. The Organization Systems Division contains systems management offices for all data systems designed primarily to serve lowest echelon organizational units. Similarly, the Base Systems Division and the Army Support Command Systems Division contain systems management offices for all data systems to be implemented at respectively higher echelons.

The various system management offices represent the primary authority within the command for assigned systems. For other than emergency programming support, they are the offices at CSC headquarters through which field units, support groups, and higher headquarters staff agencies interface with the command. They obtain the necessary resources from Headquarters, Department of the Army; surface problems and speed up the decisions necessary for their solution; and, above all, expedite the delivery of support to the user in the field.

Data systems development directorates perform actual system development, maintenance support, and emergency programming support. Each directorate is keyed to one technical specialty of the Army and contains a staff of system designers, system analysts, and computer programmers.

The Logistics Data Systems Directorate specializes in logistic systems, including supply systems, transportation systems, and materiel readiness

systems. It also represents a concentrated source of advice and assistance in these areas.

The Personnel and Force Accounting Data Systems Directorate is devoted to all matters dealing with manpower. Examples include personnel record keeping, force accounting, and medical regulating.

The Financial Data Systems Directorate concentrates on systems which serve the comptroller function throughout the Army.

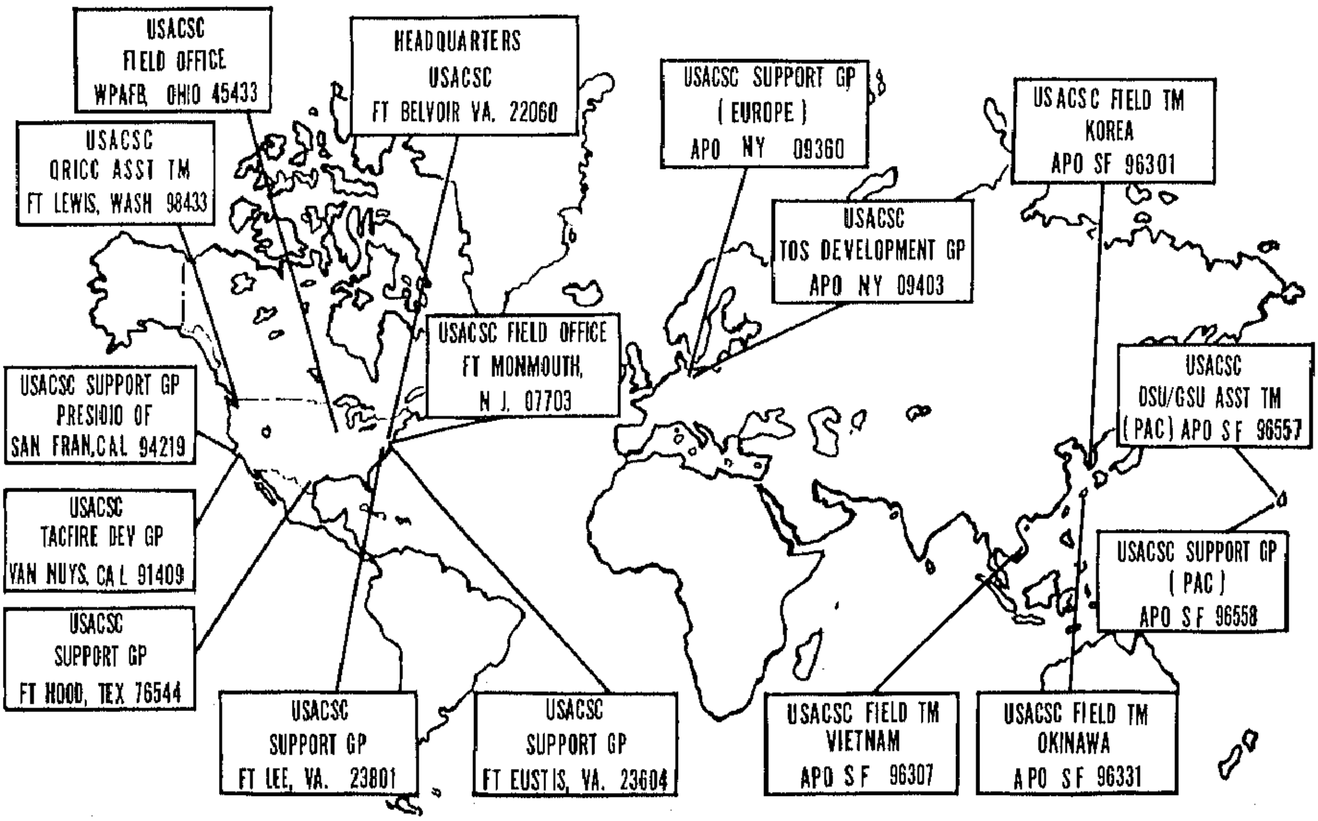
These directorates actually design and develop the data systems released to field and to fixed-station installations. They are responsible for producing a fully tested and documented operational package, and for its support once it goes into operation. Rigid adherence to test standards and procedures minimize the need for on-site emergency fixes. Each directorate maintains a full-time standby service for furnishing emergency fixes and advice to the user.

From the very start of the system life cycle, each of these directorates is the primary contact with its counterpart Department of the Army staff element responsible for defining system requirements. The directorates provide "hands-on" experience in functionally specialized ADP design. Thus, their personnel are functional specialists, as well as ADP specialists.

At CSC headquarters, the Field Operations Directorate is engaged in certifying the operability of all systems and modifications developed by the command, and in delivering them to the field. Field operations personnel coordinate and perform site surveys, advise on-site preparation, arrange for equipment delivery, and monitor acceptance tests of ADP equipment. They assist in the installation of the equipment, and assure that the hardware is ready to accept the systems workload.

Because field operations personnel also perform system testing and certification, they are expert in systems capability and operations requirements. They are experienced in data conversion planning and cutover of operations from old system to new. Field operations personnel have a working knowledge of data processing operations management—scheduling, machine room procedures, data control and utilization reporting. They serve as a central clearing house for manufacturers' support to commercial ADP equipment. They interface with the Continental Army Command to assure proper training support. Field operations personnel are proficient and ready to assist on all problems related

UNITED STATES ARMY COMPUTER SYSTEMS COMMAND



to ADP preparation and installation, and the establishment of smooth operation, whether or not the system is one the Computer Systems Command has delivered.

On the current Tactical Operations System (TOS) and the Tactical Fire Direction System (TACFIRE), systems, management and field operations are supported as on other projects, but from totally project-oriented directorates devoted to TOS and TACFIRE, and similar systems as assigned. Thus the command maintains in-depth capability, even when the problem involves Army-developed hardware and in-house Army executive software support capability.

Deputy for Technical Management

Through the staff of its Quality Assurance Directorate, the command imposes rigorous standards of quality assurance on its in-process activity. This group of ADP generalists also serves as a staff of in-house consultants to evaluate data systems design and progress, to identify incipient problems, and to make timely recommendations for their solution.

Development and modification of general purpose executive software is a growing function associated with ADP systems. General purpose software is at times inefficient and unnecessarily time consuming, when applied to a limited range of applications. Tailoring can result in significant improvements in efficiency. Particular skill is required, however, to adapt machine-oriented programs. Therefore, the Computer Systems Command has established a Design Support Directorate of software specialists who are devoted to software research and development activity, developing new techniques, and modifying manufacturers' software.

An Engineering Support Directorate, with a staff of data system-oriented electronic engineers and communications specialists, assures proper communications planning in support of multi-command ADP systems. Electronic engineers, specializing in computer equipment design, are included in this staff. This planning resource is available to all Army users of ADP systems.

Current Projects

Several major systems assigned to the Army Computer Systems Command are intended for battlefield deployment.

The Tactical Fire Direction System (TACFIRE) is an integrated truck-mounted, on-line tactical computer system being developed for the Army's field artillery units. TACFIRE is being built to increase the effectiveness of field artillery support through increased accuracy, better and more rapid use of target information, reduced reaction time, and greater efficiency in the determination of fire capabilities and the allocation of fire units to target. Specifically, TACFIRE applies automatic data processing to perform technical fire control, tactical fire control, fire planning, artillery target intelligence, artillery survey, meteorological data, and ammunition and fire unit status. One of the goals of the present program is to provide the materiel base for a family of militarized general purpose ADP equipment suitable for use by other Army tactical ADP systems.

The Tactical Operations System (TOS) is a truck-mounted combat system, an on-line automated information system incorporating remote inquiry and time sharing features. TOS is being developed to use high-speed computer facilities located at communications centers near division, corps and Army main headquarters to serve the commander, planning staff, and tactical operations centers. The objective of TOS is to increase significantly the effectiveness of tactical operations within the Army in the field in three areas: operations (including personnel and logistics summary information pertinent to the operations estimate); intelligence; and fire support coordination. The introduction of a first-generation ADP system is projected for the mid-1970 time frame, and most TOS equipment will be identical to TACFIRE materiel.

Combat Service Support System (CS3), a van-mounted automated administrative support system for use at several echelons of the Army in the field, provides through integrated automation a computer-supported logistics, personnel and administrative system to increase the responsiveness of combat service support required by the Army in the field.

Quick Reaction Inventory Control Center (QRICC) is a special combat service support which uses equipment and logistics programs of the CS3 System. The QRICC is a deployable inventory control center, using CS3 logic, which can be used in expediting the provisioning of any special task force.

Theater Army Support Command System (TASCOM) requirements are now being defined for combat service support. These requirements will be implemented by the Computer Systems Command.

Division Logistics System (DLOGS) is a van-mounted combat service support system which automates repair parts provisioning, property book reporting, and equipment status reporting. Now operational, the DLOGS system will be phased out as the more powerful CS3 system becomes ready to replace it.

The Direct Support Unit/General Support Unit Computer System (DSU/GSU) is also fully operational. It is a magnetic ledger card system used for automation of stock record accounting of repair parts (previously accomplished annually by the use of visible record files) in direct and general support units. A small-scale, low-cost computer system, using commercial off-the-shelf ADP equipment mounted in two M373 semi-trailer vans, the system is self-sufficient and operates from a 30KW trailer-mounted generator shipped with each system. Over 105 DSU/GSU systems have already been delivered to the Army in the field in Vietnam, Thailand, Okinawa, Germany and the continental United States; and 43 additional systems will be delivered by June 1970. Even after deployment of CS3, the DSU/GSU system will continue to operate as the organization level ADP system for the Army in the field, exchanging data with CS3 to assure optimum support from rear echelons.

The Personnel Management and Accounting-Card Processor System (PERMACAPS) automates various military personnel applications for the Army in the field. PERMACAPS uses card processor and peripheral equipment mounted in four transportable expansible vans. PERMACAPS combines Army division and personnel services company personnel data processing systems and the Army-wide personnel reporting system, to enhance data processing capabilities and improve internal division personnel management support. There are 37 PERMACAPS installations worldwide, with 17 additional installations planned by the end of 1970. Like DLOGS, PERMACAPS will be phased out as CS3 is deployed worldwide.

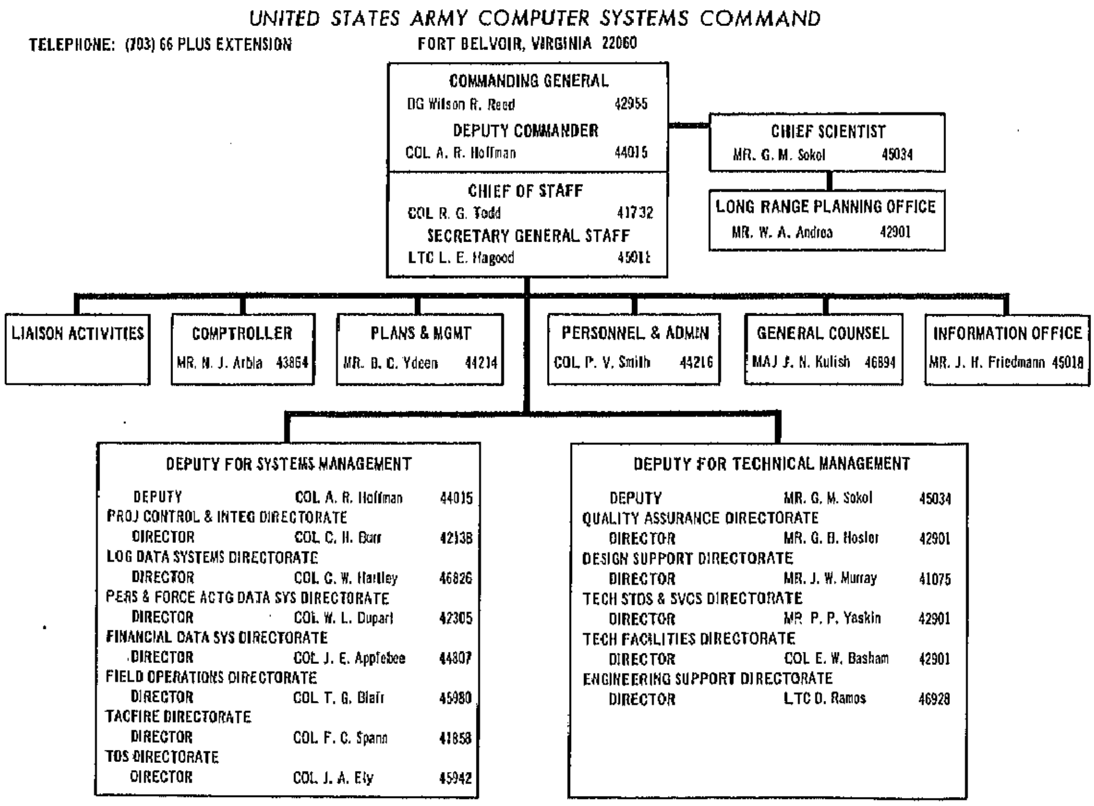
To back up battlefield automation, several other data systems, operating fixed-station installations, complete the roster of systems assigned to the Computer Systems Command:

CONARC Class One Automated System (COCOAS) is a base-level management information system designed to meet many management and reporting requirements at installation level, and to serve commanding officers of Class 1 posts, camps and stations throughout the continental United States. The prototype equipment configuration, operational at Fort Sill, Okla., uses third-generation commercial computer equipment. The fundamental objective of COCOAS is to improve the readiness of Army units by being responsive to the informational requirements of all unit commanders, and by providing timely and accurate administrative and supply support to obtain maximum effectiveness from available resources.

Centralization of Supply Management and Operations System (COSMOS) is an automated retail supply system which performs supply management and stock fund management for each continental U.S. Army. The primary equipment configuration consists of a third-generation, disk-oriented central processor with a satellite computer for communications switching.

The Standard Supply System (3S) became the responsibility of Computer Systems Command in the Pacific Theater. It is a theater-wide depot/inventory control center supply and stock fund data processing system, designed by the U.S. Army, Pacific, and responsive to the various missions of the major subordinate commands in the Pacific Theater. The 3S system processes supply and related financial transactions for subordinate command supply depots and finance and accounting offices, to satisfy depot customer's materiel demands quickly and economically through maximum use of electronic computer capabilities.

The Continental Army and Major Overseas Command System (CARMOCS) is used among other functions to maintain personnel master files of all military personnel assigned to the geographical areas of eight data processing centers, one serving each of the five continental U.S. Armies; U.S. Army, Pacific; U.S. Army, Vietnam; and U.S. Army, Europe. An equipment upgrading program is now underway. CARMOCS assures accuracy in the maintenance of active Army personnel data banks and timely processing and transmission of data. Among the benefits are management control based



on planning, standard system and strict reassignment controls, reduction of workloads, and system-wide compatibility.

Looking to the Future

Projects earmarked for assignment to the Computer Systems Command in 1970 and following years include:

The USAREUR Supply and Maintenance System was developed by the Materiel Command of Theater Army Support Command, U.S. Army, Europe (USAEUR), to provide centralized theater control of supply management, stock control, field depot maintenance, and supporting finance and transportation functions. The system is operational at the single USAEUR Inventory Control Center. Maintenance of the system will be assumed by the Computer Systems Command early in calendar year 1970.

The Army Authorization Document System (TAADS) is a guidance and reporting system in the definition stage. CSC personnel are participating members of the TAADS team of Headquarters, Department of the Army, to initiate the life cycle. A General Functional System Requirement is currently being developed. The Computer Systems Command is anticipating the assignment of TAADS as an additional operating information system within several of the established projects.

Integrated Facilities System (IFS) is a guidance and reporting system in the development stage within Headquarters, Department of the Army. CSC liaison with the proponent, Deputy Chief of Staff for Logistics, is being accomplished in the development of Functional Systems Requirements.

Military Police Operating Information System (MPOIS) is a system for the support of military police functions in the definition stage. CSC liaison has been established.

Communications-Electronics Management Information System (CSMIS) is a system to support the Assistant Chief of Staff for Communication-Electronics. The initial application is "Automated Frequency and Call Sign Assignment Procedure for the Army in the Field." CSC personnel are working closely with Headquarters, Department of the Army, in planning for the installation of the contractor-developed system.

Greater Force Effectiveness

The Army Computer Systems Command is a single agency whose functions cover life-cycle project management, systems development, and systems support for all Army multicommand data systems. Substantial manpower growth of the command is projected for the next five years, but centralizing control over system development and support will lead to better application of resources, and far more data processing capability with, if anything, a net reduction in requirements for scarce design and support talent.

Automation does not add to the nation's defense arsenal; it multiplies its effectiveness. The systems being developed and delivered by the Computer Systems Command to the Army in the field and at home do not do the soldier's thinking for him. They incorporate data shaping machine tools, relieving the soldier of the drudgery of rethinking tactical and administrative processes which have already been thoroughly defined by experienced doctrine developers and top managers. As such, they multiply the effectiveness of the weapons available to the Army today.

The Computer Systems Command is dedicated to this force effectiveness multiplication in an era when additives are not likely to be sufficient.

DCA Sets Up DECCO-Europe Office

The Defense Communications Agency (DCA) has established a Defense Commercial Communications Office (DECCO) in Europe.

DECCO-Europe, at Sembach Air Base, Germany, joins DECCO-Pacific, in Hawaii.

DECCO's mission is to procure, account and pay for leased communications facilities, services and equipment for the Defense Department and other government agencies, as designated by the Secretary of Defense.

USAF To Get Portable Instrument Landing System

The Air Force has completed testing and evaluation of a new lightweight portable instrument landing system for use at combat airfields. A contract was awarded to the Kearfott Division, Singer-General Precision, Inc., Pleasantville, N.Y.

Designated the AN/TRN-27, the equipment is commercially known as TALAR IV (for tactical approach and landing aid). First units are expected to be in use in the field in about one year.

The TRN-27 is a microwave electronic system consisting of two units: a ground transmitter and an airborne receiver. The transmitter, weighing only 57 pounds, can be set up and aligned by one man. It can operate from three different power sources: 24 volt DC (battery); 28 volt DC (portable generator); or 115 volt 60 cycle AC (standard house current).

The solid state receiver consists of a radio frequency head, with antenna, and course interpreting circuits, and operates on 28 volt DC aircraft power.

Maximum range of the AN/TRN-27 is about 30 miles. Minimum usable range under conditions of a ½-inch-per-hour rainfall is about 11½ miles.

New MUST Components Tested by Army

Testing of additional components for MUST (*M*edical *U*nit, *S*elf-contained, *T*ransportable) hospitals has resulted from successful service of these units in Vietnam since 1966. The Army Surgeon General has called for eventual conversion of all Army field hospitals to these revolutionary units.

To expand their utility, the Army Materiel Command has undertaken testing of a water and waste management system for MUST. Testing is also planned on a MUST food service system, including a dining room for staff and ambulatory patients. Other equipment developed for MUST units includes pharmacy, X-ray and dental facilities, sterile preparation rooms, and a clinical laboratory.

FROM THE SPEAKERS ROSTRUM

The Battlefield of the Future

Address by Lt. Gen. George I. Forsythe, USA, Commanding General, U.S. Army Combat Developments Command, Ft. Belvoir, Va., at DOD-National Security Industrial Assn. Symposium on Sensor Aided Combat Systems, Gaithersburg, Md., Jan. 8, 1970.

In a recent address Army Chief of Staff General William C. Westmoreland spoke of a "quiet revolution" in ground warfare. This revolution has some of its roots in Vietnam, but others are found in the variety of materiel and conceptual developments associated with the Army's continuing search for greater effectiveness. These developments are quietly changing the shape and substance of land combat operations and forces. New capabilities are bringing us progressively closer to a battlefield concept involving the employment of highly integrated combat systems heretofore undeveloped. The objective of all this, of course, is success in battle with minimum loss of human life—our nation's most precious asset.

This goal derives from the very essence of our national character. Unlike certain other world powers, we, as a nation, have always placed a high premium on the inherent value of human life. Our political and industrial development has constantly searched for ways to relieve men from danger, drudgery and demeaning toil; these value scales on human endeavor are also translated to the battlefield.

To state it simply, the Army must take full advantage of our exploding technology to improve our effectiveness in supporting national aims, while at the same time reducing our manpower requirements and the exposure of our men to the dangers of the battlefield. Stated another way, we now have greater opportunities to replace men with machines while, at the same time, bringing into being a U.S. Army operational capability superior to that of any possible opponent.

With the course thus defined, it is, then, very clear that we will continue to depend on the teamwork of the industrial, scientific, academic and military communities.

Development Program

The Army's developmental program considers concepts and requirements within the framework of the five functional areas of land combat. We delineate them as: intelligence, mobility, firepower, command and control, and logistics support.

For the purpose of the discussion to follow, I prefer to simplify these five functions into three. I guess this is because I had some very good training by my platoon sergeant when I was a very junior second lieutenant almost 30 years ago. Sergeant Donkowsky, then a veteran soldier, explained that the basic job we had to do was "find 'em, fix 'em and fight 'em, feeding all the while." He gave me that advice during a time when our ability to "find 'em" was pretty much limited to observation posts and listening posts, limited to a man's eyes aided by a pair of binoculars, and to his ears occasionally aided by a hearing horn! We had little in the way of aids to extend man's basic physical senses.

Then, our ability to maneuver on the battlefield to *fix* the enemy was limited pretty much to the "Munson Last" Army field shoe, a 2½-mile-per-hour means of transportation. At best, our tanks and trucks could move about the battlefield at something like 5 miles per hour.

Lieutenant General George I. Forsythe, USA, is Commander, U.S. Army Combat Developments Command. Previously, he commanded the Army's Infantry Center and Infantry Shool, Fort Benning, Ga. He has been Commander of the 1st Cavalry Division (Airmobile) in Vietnam. He is a graduate of the University of Montana and the Air War College.

Our ability to "fight 'em" was based on a family of weapons that had evolved from World War I: the old heavy water-cooled machine gun, the stokes mortar, the U.S. version of the "French 75" field piece, and the British "one pounder." Our logistics support—"feed 'em" systems—were equally primitive.

World War II and Korea saw advances in hardware, but relatively recent developments are having a major impact on the land combat system of our country. Because we have already adopted the major advances that have been made in our ability to "fight 'em," I want to enumerate a few of those first.

To "Fix and Fight 'Em"

Transistors and small power sources have had a major impact on munitions technology. Combine these developments with advances in computer technology, and we have small anti-tank and air defense missiles giving us high hit-kill probabilities at longer ranges than were ever attainable in the past. Progress in weaponry continues as laser technology, developments in lighter-weight metals, and computer science applications are exploited.

Our ability to maneuver to fix and to fight the enemy has also been greatly improved by the helicopter. On the battlefield, living and fighting with the soldier, the helicopter has provided a revolutionary advance in mobility and responsive firepower. No longer are we constrained by terrain obstacles that require a back-breaking effort to surmount. The agility, speed and flexibility of the helicopter, coupled with fire suppression techniques, have established the role of the helicopter on the battlefield as a "fighter *and* feeder." Further advances sought in helicopter technology are in the areas of all-weather capability, improved weapons-delivery capabilities and improved speed and lift capabilities.

Together, improvements in firepower and mobility give us a greatly increased capability to fix the enemy as well as to fight him, once fixed. However, the key to exploiting this increased capability is our ability to find the enemy, for if we can find him quickly and accurately, then we stand a good chance of fixing and defeating him.

To "Find 'Em"

This is the aspect of land combat that requires the greatest effort now —the "find 'em" problem! American technology is about to provide us with the means by which combat areas can be under 24-hour real time, or near real time, surveillance of many sorts. Once this is achieved, virtually instantaneous communications, combined with applications of increasingly effective firepower, will permit the selective engagement of any target identified on the battlefield.

Some progress is being made to close the intelligence gap. Each year witnesses substantial improvement. In Vietnam, we learned, and quickly, to adapt and refine combat and intelligence units to be responsive to the unique requirements of fighting that enemy; we found ourselves more and more using the infantry to *find* as well as *fight* the enemy; and we organized special reconnaissance elements of all kinds, including long-range patrol companies and special forces teams. We learned to break down into small units when the enemy did, and to operate with growing skill at night. Intelligence organizations necessarily saw considerable expansion and refinement. Sensors of all kinds were introduced to great advantage. But we were just scratching the surface in this field and other technical fields to support surveillance operations—electronics interceptors, side-looking radars, sensory devices like the "People Sniffer," the Starlight Scope, and improved front line surveillance radar.

Within the past year, additional steps have been taken to coordinate and accelerate the entire Army-wide Surveillance, Target Acquisition and Night Operation (STANO) effort. STANO development is further enhanced by the recent creation of a test facility at Fort Hood, Tex.—Project MASSTER—to carry out the actual experimentations, evaluation and integration of new STANO doctrine, equipment and organizations. Combat Developments Command (CDC) is another important part of this carefully designed management program; for, drawing from past experience, expanded capabilities in the field depend on far more than just the development of new equipment. Concepts of doctrine, organization and training must be formulated in time to meet new hardware as it rolls off the production line.

Land Combat System Design

CDC is responsible for preparing a conceptual design for a land combat system of the future. While this design is not yet fully developed, I will give you one example of a design approach to assist the commander in the field in carrying out the functions of combat, and to provide maximum improvement in the application of the principles of war.

Our conceptual design must be based on three elements: the future threat, as we see it; present operational trends based on experience; and materiel development, both present and projected. As background to my description of present Army thinking on the land combat system of the future, I want to say a few words about the threat and present trends—I have already remarked on advances in the materiel area.

Threat Assessment

In describing the threat as we see it, I must first caution you not to misinterpret my remarks as predictive—the efforts of CDC must be based on *potential* enemy capabilities and all possible involvements of our nation in ground combat.

In assessing the threat which the U.S. Army may face in the future, we consider not only the current military capabilities of potential enemies, but equally, if not more important, we must try to visualize the significant advances they are likely to make. We know of the Soviet's keen interest in achieving a world leadership position in technology, and we can expect their technological achievements to be reflected in their future military forces. We know that Communist China is

far from idle in regard to its military posture. Whether or not direct ground combat confrontation between the United States and either of these major powers occurs, any other enemy the United States may face will most assuredly be supported by one or both.

The U.S. Army must be designed, equipped and trained with an inherent flexibility to meet the full spectrum of any enemy ground threat from an insurgency in an under-developed country to a nuclear-supported ground assault across Western Europe.

Trends for Future Development

To a degree, some aspects of the battlefield of the future are being demonstrated in combat in Vietnam. I want to draw your attention to two—of many—trends that impact on the land combat system. These trends constitute another basis for future development.

First, we see an increasingly discernible trend toward what I will call the "porous battlefield." This has been brought about by a continuing decrease in the population density of combat areas. Obviously, this trend is not entirely new with the 1960s. Even the briefest look at the history of warfare will show that the density of the battlefield, in terms of people per square mile, has seen a relatively constant lessening as a result of improvements in weapon capabilities and ranges, and the restructuring of battle tactics and organizations following technological breakthroughs. But in terms of actually expanding the tactical area that can be positively dominated, controlled and engaged by a decreasing number of individual human beings, the tactical commander must have a greater capability of knowing accurately what is going on in that area on a real-time basis. The day of the binoculars, the listening post, and the mounted messenger is long past.

The second important trend, closely allied to the notion of a porous battlefield, is an increased "stand-off" factor in every aspect or function of combat operations, ranging from actual fire delivery, through support services for combat units, to the very means employed to gather or transmit information and intelligence to the tactical commander for decision-making purposes. Stand-off means simply that hand-to-hand, or "eyeball to eyeball," combat will become increasingly rare. Battlefield opponents literally stand off from each other, horizontally and vertically, and thus are frequently invisible to each other. The side that can best employ technological means to find and engage the other has the marked advantage.

The trends of the porous battlefield and increased stand-off lead to a visualization of how combat will be conducted in the future. Increasingly mobile units will be employed to fix and destroy the enemy. A growing proportion of these will be airmobile forces covering vast tracts of land and making swift, deep penetrations with wide dispersion and rapid post-offensive withdrawals to numerous small bases outside the immediate combat area, linked by a communications network. Logistics units will provide support for combat forces with mobility and response ratios approaching one to one. This should eliminate requirements for some echelons of support, and involve the employment of "inventory in motion" techniques with a marked streamlining of the logistics pipeline. Support of Army forces by the Air Force will include direct support to consumers from bases located within the continental Unied States.

Integrated Battlefield Control

The integrated battlefield control system concept, the concept around which the battlefield of the future is being developed, capitalizes on technological advances in sensors, communications, fire direction, and associated automatic data processing capabilities. Already, elements of this system are well down the road in the Army's Automatic Data Systems for the Army in the Field (ADSAF) effort. Within ADSAF fall the Tactical Fire Control System, the Combat Service Support System, and the Tactical Operations System programs. The ADSAF program is a part of the quiet revolution in the Army's capabilities.

With the foregoing as background, let me proceed to a general description of the design for the battlefield of the future. To get at an orderly method of improving operational capability, which is the heart or core of the design, we must work around doctrine, organization and equipment, with the principles of war leading the way. We want to maximize the doctrine of security. Knowledge of the enemy is the first necessity of security; therefore, an organization must be built to gather knowledge of the enemy. A surveillance force is proposed for the purpose of finding the enemy, providing intelligence, and providing target acquisition. This force is not intended to deliberately engage the enemy. Surveillance is a continuing requirement. A dedicated force of approximately 10 percent of the command is envisioned for this purpose.

We estimate that any forward deployed U.S. Forces will have to rely on the principle of economy of force. This will be particularly true of that element we call the restraining force. The major mission of this force is that of blocking, blunting and canalizing the initial enemy offensive. Relying on intelligence developed by the surveillance forces, it must be highly mobile, designed to kill armored formations and supported by flexible firepower. *Wherever possible, these organizations must emphasize replacement of the man by the machine.* They must combine the maximum use of terrain, barrier systems and organic mobility to force the enemy attacking formations into areas best suited for destruction.

We visualize the restraining force as self-contained, self-supporting organizations, capable of fighting until relieved or reinforced by heavier battle forces moved to the areas of greatest threat.

Recognizing the requirement for positive command and control of this phase of the battle, the restraining force will be equipped for rapid passage and processing of information and orders. We might say that in this type of operation, the "instrumented battlefield concept" is best typified. Approximately 20 percent of the command would constitute the restraining

force.

Mass and maneuver are associated best as principles of war related to destruction of the enemy in battle. The battle force to best fight the enemy should be organized with a combined arms structure and extensive cross-training. In the interest of responsiveness, ground combat vehicles should be organic to the battle force. Future combat vehicles should exploit new power sources, such as steam or gas turbines together with liquid propellant weapons, to improve mobility and firepower. This basic design of the land combat system leads to further considerations.

Higher Command Echelons

The primary organizational structure consisting of surveillance force, restraining force, and battle force would be found not only in the basic combat unit but repeated through higher echelons for assurance of simplicity and unity of command. Special purpose forces would be found at higher echelons of command.

To permit tailoring of the primary organizational structure, a reinforcing command predominately of combat arms is necessary at high echelons. These organizations, other than general support units, should lend themselves to attachment to the primary organization and, because increased density of equipment is a goal, should have similar equipment to that of the primary organization. Gun-type and utility-type aviation units should be a part of this command. In the interest of commonality of equipment, all prime movers and lift devices should accept a variety of loads such as personnel, weapons, and general cargo.

At some levels, a sustaining command which contains logistic, maintenance, and administrative units is necessary. Improvements in this area are expected to be derived mainly from the use of digital transmission, computerization, and automatic scanning. Coupled with rapid all-weather transport, this should permit reduced forward stocks and dependence on a moving inventory. A high density of common major items of equipment should reduce spare parts requirements and simplify maintenance.

Challenges of the Future

The Army has taken its first steps toward instrumentation of its command and staff functions of the Army in the field. This is the initiation of an expanded instrumented battlefield. When the communication and electronics systems in the command and staff area prove reliable and beneficial in automating staff activities, the instrumented battlefield will be expanded to include tactical operations of a restraining force as previously described.

Still, none of this will happen automatically. Our development effort must be guided by a sound appreciation of past errors, new avenues of approach, and proper allocation of priorities. This is especially crucial as we enter a period of constrained resources in terms of both manpower and cold dollars and cents.

One of the principal challenges before us today is to make the right decisions on how much of our resources must be expended to gain a better balance in land combat functions and, thus, improve greatly our effectiveness in battle.

We have computers, but our achievements in systems engineering are crude when compared to American technological capabilities. We have night vision devices and sensors of varying degrees of sophistication; improvements are needed, however, in equipment ranges, target discrimination, security against countermeasures, and—not the least problem by a long shot—in cost. The Army has the management structure to direct our combined efforts to bring together existing materiel, requirements for new materiel, doctrine, organization, training, and unexpected technological advances to make the battlefield of the future a reality; a battlefield on which the U.S. Army will attain success in battle with greatly increased effectiveness and a greatly reduced cost in human life!

Armored Windshield Ceramic Developed by USAF

A prototype sample of transparent material, suitable for double duty on helicopters as armored windshields, has been developed under the sponsorship of the Air Force Systems Command's Air Force Materials Laboratory (AFML), Wright-Patterson AFB, Ohio. Contractor for the program is AVCO Corp., Applied Technology Division, Lowell, Mass.

The material is polycrystalline magnesium oxide fabricated into an optically transparent ceramic piece 11 inches in diameter and 3/16 of an inch thick. "Hot pressing" was used to manufacture the disc which has an optical transmission of about 80 percent and excellent visual clarity. Ultimate objective of the program is to perfect a reproducible and reliable manufacturing process to produce optically transparent tiles of the material up to 8 by 8 inches with thicknesses of 3/4 of an inch.

Lawrence Kopell of AFML's Manufacturing Technology Division is project engineer.

DDR&E Reorganizes

The Director of Defense Research and Engineering, Dr. John S. Foster Jr., is reorganizing his office in line with the Secretary of Defense's participatory management philosophy on weapon systems acquisition.

The reorganization will reduce the amount of DOD direction and guidance, with a resulting shift from detailed program supervision to long-range coordinated planning. Project approval will remain on the DOD level, but the Services will originate and have primary responsibility for the conduct of the programs.

Reorganization involves two directorates that deal with military programs, Tactical Warfare Programs, and Information and Communcation, and will result with structuring along mission, rather than functional, lines. A third directorate, Strategic and Space Systems, is already organized along mission lines and will not be changed.

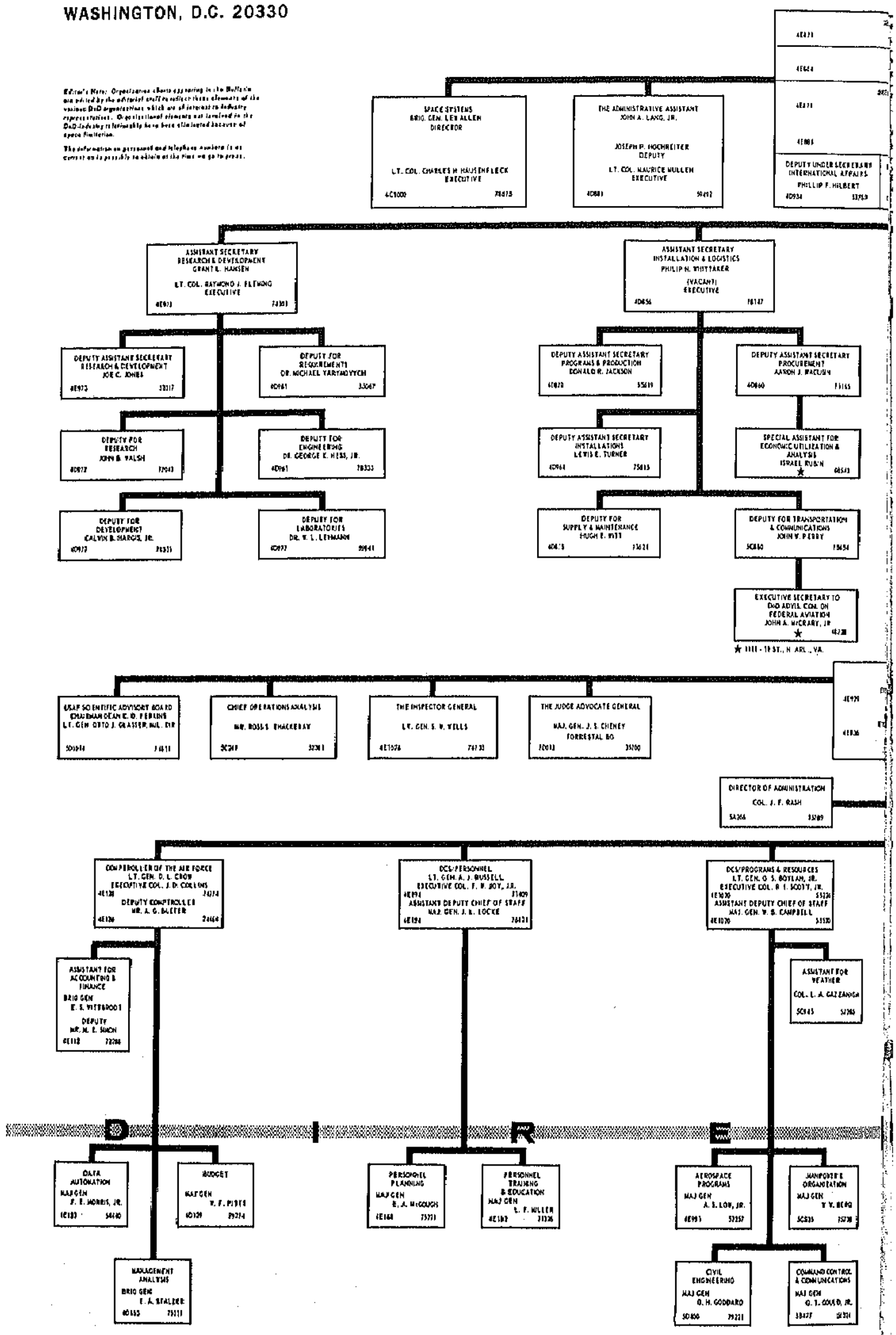
The reorganization is expected to be completed by June 30, 1970, and is expected to allow a 10-percent reduction in personnel strength.

DEPARTMENT

WASHINGTON, D.C. 20330

Editor's Note: Organization charts appearing in the Bulletin are edited by the editorial staff to reflect those elements of the various DoD organizations which are of interest to industry representatives. Organizational elements not involved in the DoD-industry relationship have been eliminated because of space limitation.

The information on personnel and telephone numbers is as current as is possible to obtain at the time we go to press.



THE AIR FORCE

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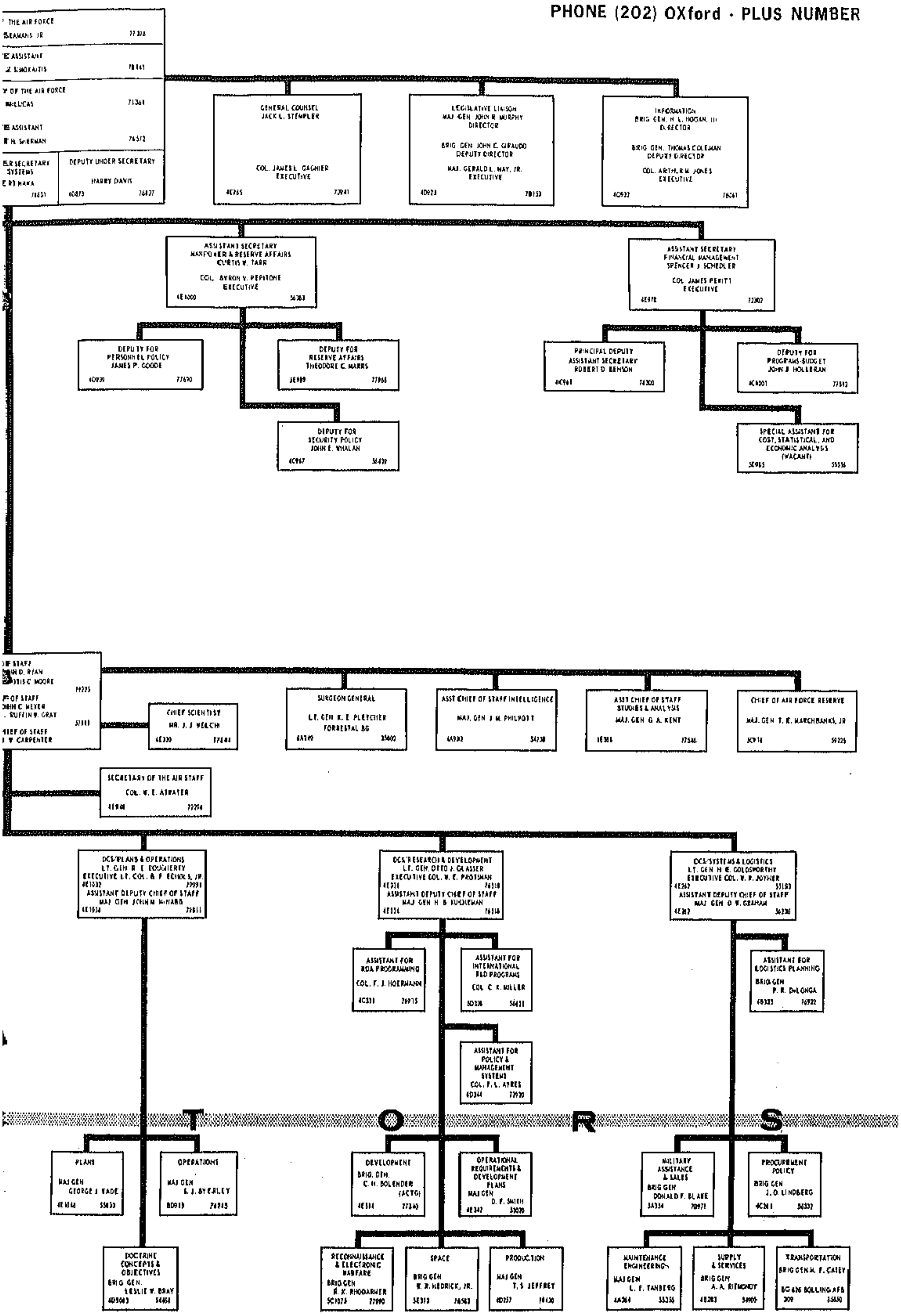

ABOUT PEOPLE

DEPARTMENT OF THE NAVY

VAdm. **Arthur R. Gralla**, formerly Naval Inspector General, Dept. of the Navy, has been named Commanding Officer, Military Sea Transport Service, Washington, D.C.

RAdm. **Roy G. Anderson**, who has been serving as Senior Navy Member, Weapon Systems Evaluation Group, Office of Dir., Defense Research and Engineering, has been designated Dir., Long Range Objectives Group, Office of the Chief of Naval Operations.

RAdm **Ben B. Pickett** has been reassigned from Dir., Fleet Readiness and Training Div., to Dir., Plans and Programs Div., Office of the Chief of Naval Operations.

RAdm (selectee) **Donald D. Engen**, has been assigned as Dep. Dir., Strategic Plans and Policy Div., Office of Dep. Chief of Naval Operations (Plans and Programs).

RAdm. (selectee) **A. R. Marschall**, formerly Commanding Officer, Southeast Div., Naval Facilities Engineering Command, Charleston, S.C., has become Dep. Commander, Pacific Div. of the command and Officer in Charge of Construction, Naval Facilities Engineering Command Contracts, Republic of Vietnam. His replacement as Commanding Officer, Southeast Div., is **Capt. Whitney B. Jones.**

DEPARTMENT OF THE ARMY

New assignments in Hq., Dept. of the Army include: **Maj. Gen. Allen M. Burdett, Jr.**. Dir. of Army Aviation Office of Asst. Chief of Staff for Force Development; Brig. Gen. **Bertram K. Gorwitz**, Dep. Chief of Information; and Col. **Theme T. Everton**, Asst. Dep. Chief of Staff for Supply and Maintenance, Office of Dep. Chief of Staff for Logistics.

The Army Materiel Command has lidated the former Procurement and Production and the Materiel Requirements Directorates into the Directorate of Requirements and Procurement. Maj. Gen. **Felix J. Gerace** heads the new directorate with Brig. Gen. **Frank A. Hinrichs** as Dep. Dir. for Procurement, and **M. D. Finn** as Acting Dep. Dir. for Requirements.

Other assignments in the Army Materiel Command are: Col. **Walter C. Gelini**, Commander, and Lt. Col. **Jay E. Luther**, Coordinator for Research and Development, at the Army Mobility Equipment Research and Development Center, Ft. Belvoir, Va.; and Dr. **Geoffrey E. H. Ballard**, Dir. of the Institute for Exploratory Research, Army Electronics Command, Ft. Monmouth, N.J.

Brig. Gen. **Edward B. Kitchens Jr.** is the new Commander, Army Combat Developments Command Combat Arms Group, Ft. Leavenworth, Kan.; Col. **Thomas W. Brown** has assumed the post of Commander, Army Combat Developments Command Experimentation Command, Ft. Ord, Calif.; and Col. **Walter R. Harris** is the new Commanding Officer, Army Combat Developments Command Field Artillery Agency, Ft. Sill, Okla.

DEPARTMENT OF THE AIR FORCE

New assignments to major command positions announced by the Air Force include: Lt. Gen. **Thomas K. McGhee**, Commander, Aerospace Defense Command, Ent AFB, Colo.; Lt. Gen. **Francis C. Gideon**, Vice Commander, Air Force Logistics Command, Wright-Patterson AFB, Ohio; and Lt. Gen. (selectee) **James C. Sherrill**, Vice Commander, Military Airlift Command, Scott AFB, Ill.

New assignments in Hq., USAF, are: Maj. Gen. **John M. McNabb**, Asst. Dep. Chief of Staff, Plans and Operations; Maj. Gen. **George J. Eade**, Dir. of Plans, Office of Dep. Chief of Staff, Plans and Operations; and Maj. Gen. **Henry B. Kucheman Jr.**, Asst. Dep. Chief of Staff, Research and Development.

Brig. Gen. **Donald F. Blake** has become Dir. of Military Assistant and Sales, Office of Dep. Chief of Staff, Systems and Logistics, Hq, USAF, replacing Brig. Gen. **Harold V. Larson** who retired on Feb. 1.

Brig. Gen. **Otis E. Winn** has been assigned to the Military Traffic Management and Terminal Service, Washington, D.C., as Dep. Commander for Resources and Management. He replaces Brig. Gen. **Thomas L. Hayes** who retired on Feb. 1.

At Hq., Air Force Logistics Command, Wright-Patterson AFB, Ohio, the command's Advanced Logistics System Center was merged with the Comptroller office on Feb. 1. Maj. Gen. **Joseph R. DeLuca**, who formerly commanded the center became AFLC Comptroller and will head the combined organization. He replaced Brig. Gen. **John French** who retired on Feb. 1. Also in AFLC, Brig. Gen. (selectee) **Wesley L. Pendergraft** has been assigned as Vice Commander, Ogden Air Materiel Area, Hill AFB, Utah.

Personnel changes at Hq., Air Force Systems Command, Andrews AFB, Washington, D.C. are: Maj. Gen. **John L. Martin Jr.**, Asst. to Commander, AFSC, for Systems Acquisition Management, has retired (no replacement named at press time); and Col. **Leslie L. Dunning** and Col. **Richard E. Griffin** has been named Asst. and Dep. Asst. for the F-111 Program, respectively.

New assignments in the Office of Aerospace Research (OAR) are: Col. **Donald C. Kipfer**, Asst. Dep. Chief of Staff, Plans and Programs, Hq., OAR, 1400 Wilson Blvd., Arlington, Va.; and Col. **Charles A. Smith** will replace Col. **Orville J. Kvamme** as Vice Commander, Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. Col. Kvamme will become commander of the European Office of Aerospace Research in July 1970.

Cost Management—
Set Goals
Measure Progress
Correct Problems

Brigadier General Harold C. Teubner, USAF

Distinctions between cost management, cost tracking, and cost control have become clouded. This is not difficult to understand because these functions are highly interrelated. Either of the latter two functions possesses peculiar objectives of cost management, yet alone they are not sum and substance of cost management. The Air Force Systems Command has a major responsibility in the area of cost management which, necessarily, extends to defense contractors performing on major aerospace weapon system programs.

In a large view, cost management is the process of establishing achievable goals and the significant steps necessary to achieve them within a time schedule and planned cost, and of measuring progress along a predetermined path. Progress along this path is reviewed when deviations occur, or circumstances suggest the need to revise either the goals or the route toward their achievement. A cost management information system reflects these goals, the status of progress, and possible problems (either trends or occurrences) which may identify the need for corrective action.

A cost management system must, of necessity, include both the elements of information and formulation of alternatives, their selection and execution. In complex weapon systems development and acquisition processes, there must occur iterative cycles of planning, identifying new or previously unidentified problems and their causal factors, selecting action and executing. Cost management is both acquisition of meaningful information and judicious application of this knowledge to assist in follow-through management. Cost estimate tracking and cost control are both tools (information) and management processes that contribute to the total of cost management.

Cost Tracking

A historical record of cost estimates, changes in estimates, and reasons for the changes, in sufficient detail to reconstruct a running and credible explanation of what has happened, allows management to grasp quickly significant facts concerning estimate trends and reasons for growth in the estimate. Derived background information on the cost track complements the record with an explanation of the cost growth, and materially aids justification of funds requirements.

Cost estimate tracking is a tool for the derivation of information but it does not, in itself, derive the background information. Instead, it isolates or defines estimate areas requiring more detailed attention, and the manner in which estimate data will be

Brigadier General Harold C. Teubner, USAF, has been Deputy Chief of Staff (Comptroller), Air Force Systems Command, since 1967. His previous assignment was Deputy Director of the Budget, Hq., U.S. Air Force. His military career has included assignments in operations and research and development. He holds a bachelor of science, Texas A. and M., master of science, Massachusetts Institute of Technology, and master of business administration, George Washington University. He also was graduated from the Air War College and Industrial College of the Armed Forces.

exploded downward for greater visibility. Procuring weapon systems is unlike buying off-the-shelf items, where comparison of prices is possible before selecting a given manufacturer's product. Instead, a determination of resources required to produce a complex system must be made based on historical records on analogous systems and from knowledgeable forecasts of needs, and then reduce these data to dollars. This reduction of resource requirements to dollars introduces the added problem of the changing value of the dollar over time. Thus, estimate tracking serves a dual purpose: tracking and evaluating dynamic departures from estimates that bear upon the immediate contract, and updating cost estimates for application to future programs.

Cost Control

It is a relatively easy task to establish controls; it is more difficult to operate them. Control mechanisms are employed to assist management and managers. The managerial function of control is measurement and correction of performance to assure that organizational objectives are reached. The management function of control seeks to compel events to conform to plans. Thus, control systems are regulators only to the extent that they define who is to regulate, and what is to be regulated. They define events to be controlled and, more important, they define the response, *i.e.*, management action. The quality of the control system and the degree to which it is understood by the "controller," who is the man in the control system, is very significant. A traffic signal, as an example, is part of a traffic control system. It can change colors all day long and not control anything if responsive actions are not taken by the pedestrian manager and the vehicular manager.

Misunderstanding of the cost control concept has increased with the
growth of data processing
What has resulted is an
the distinctions be-
ecisions and manage-
clerical decision is
he facts are known
alternatives can be
applied to the exact conditions that justify them. In a management decision, all the facts are not precisely defined and the one best alternative is not so easily discerned. There are elements of both in a cost control system. Automatic data processing has provided ability to gain more data that assist in properly reclassifying some management decisions as clerical decisions. Clerical decisions can be programmed for direct responses to a management decision that has already been determined. Many tangible and intangible factors still exist in the technology and in the environment of weapon systems acquisition and management. This fact precludes early elimination of all management judgments by a totally mechanized management control system. The man in management is still a necessary element of the control system.

Cost/Schedule Control System Criteria

Cost estimate tracking, cost control, and cost information systems are elements of the larger cost management system. Well known by implementation is the specification or set of criteria for control systems, formerly known as the Cost/Schedule Planning and Control Specification, but now adopted DOD-wide as the Cost/Schedule Control System Criteria (C/SCSC). The control system resulting from the application of these criteria is extensively coupled with other subsidiary systems included in the overall cost management system. In many respects, C/SCSC extends basic parameters of other subsidiary cost management systems. This is done primarily through commonality of component elements, and extending common elements to serve a more discrete performance measurement function.

Basically, C/SCSC provides criteria for contractors' internal cost and schedule control systems that are coupled with each other and with other components of the cost management system. The same elements of these systems, that serve to support objectives of other cost management subsystems, are used as the foundation of cost and schedule performance measurement. Performance measurement, in turn, is directly related to the performers responsible for follow-through or feedback. C/SCSC builds upon the use of control features that more accurately represent a measure of the work being performed, as it is understood by those accomplishing the many tasks. It provides for classification and grouping of management information to make it more meaningful for the specific management level that will use it.

In this respect, C/SCSC organizes management and the information that supports the management process by both program configuration and functional structure. Inherent in the concept is the assumption that upper levels of management are more effective in evaluating and acting upon program status and program future in larger segments. Operational levels are more effective in evaluating and acting upon management information concerning near-term events, for this is the way their work and responsibilities are assigned. Logic, traceability and credibility of data provided to top management is dependent upon these data being derived from various additions and summaries of the same basic management information that serves operating levels (see Figure 1).

Major Action Elements

The three major action elements in a cost control system are approached by C/SCSC in the following manner:

Identification of What Is To Be Measured and Results from the Planning Process

All resources known or expected to be applied toward meeting program objectives must be planned for. Planning is performed in terms of the inputs, men, time, and other resources required to provide given output. Several control measurements are necessary:

- Functional control, by category and related cost elements.
- Organizational control, by the organization or suborganization assigned task responsibility.
- Financial control, its budgetary process and measurement of its accomplishments.

• Schedule control, application of resources in a timely manner to accomplish program objectives.

• Product control, measuring the output to date and forecasting future output to be obtained from the application of given resources.

Coupling of control systems is best obtained when planning includes these interrelationships. Planning must result from the definition of the work, who is to perform it, estimate of resources required, and period of performance. All are criteria requirements.

Coupling of Related Disciplines that Serve Common and Individual Objectives

Contributing systems can be integrated by translation between systems, *i.e.*, conversion through some interface so that they address some summary management requirement. A more direct integration is that which is built into C/SCSC. Two areas illustrate this coupling feature:

• *Related Disciplines.* Inherent in all management systems are the disciplines of planning, budgeting, work authorization, and cost and schedule determination. These disciplines must be coupled together to achieve maximum effectiveness and to assure consistency: planned work must be adapted to budget limitations; work authorized to perform planned tasks must be consistent with the budget; tasks introduced into the planning process must be derived from the contract objectives. Determination of cost and schedule status must follow the work planned, budgeted and authorized.

• *Cost Elements and Cost Categories.* Cost elements are direct labor hours and dollars, material dollars, and other direct costs. Cost categories are classification of the costs by functional inputs to product components and component subdivisions. They are coupled as in this example. Direct labor hours are accumulated to support many requirements. Total hours are segregated into functional categories: hours needed to perform work on a given component or subcomponent of the program; and unit costs and classification by recurring and nonrecurring costs, and by types of funding dollars. These summaries directly support cost estimate tracking and cost information reports.

The process starts with manhours estimated and expended for the lowest level of work indenture. C/SCSC work packages, therefore, were created on this same basis. Performance is measured by the application of cost elements to the lowest level of resources application. Although work packages may be a larger aggregate of the lowest planning unit, they are exact additions of these lower planning units. Thus, the same base that serves a higher purpose in cost estimating or cost information systems is the base for performance measurement.

Performance measurement units derived in C/SCSC have a direct relationship with other cost management systems. Related work packages are summed into cost accounts that are functional in nature, with separate identification of cost elements. By their functional nature, cost accounts are components in a specific functional control. Because cost accounts represent functional effort, the total of the several functional inputs summarizes the cost of the contract end item. Similarly, a single functional input can be discretely identified in a contract end item or a work breakdown structure (WBS) element (see Figure 2, page 24).

Further classification of cost accounts by recurring or nonrecurring work permits development of appropriate cost accounts and their summaries to provide the manager not only performance measurement, but tracking of estimate performance and related progress toward discrete objectives by this and other classifications. The same base data, thus, is more fully exercised.

Feedback into the Management System To Provide Knowledge on Status of Program

Feedback is the process whereby the results of yesterday's operations are applied to and affect tomorrow's operations. Feedback is not only relating what has occurred and why, but is application of this new learning and experience into the management of tomorrow's operations. This impacts

FUNCTIONAL STRUCTURE AND PROGRAM CONFIGURATION

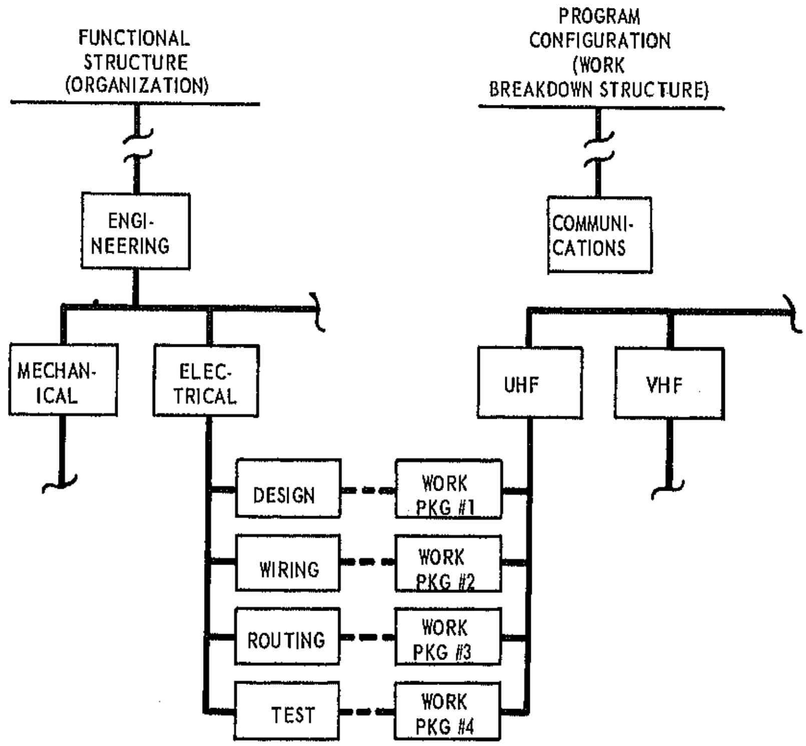

Figure 1.

upon the entire cost and schedule control system because what has already occurred obviously cannot be controlled. All that is left to control is what lies ahead. Thus, feedback defines forward control and actions taken to achieve desired control limits.

Variance Analysis

The heart of an operating cost/schedule control system is variance analysis. It is not enough to know where cost is departing from predetermined controls. Factors underlying this departure must also be discovered. Though much has been made of traceability and credibility of summarized management information, status alone is not enough. Disengagement of the Government from detailed contract management should not be confused with disengagement by the contractor from detailed program management.

The nature of the cause of variances becomes more discrete and subject to better control as it is broken down level by level. For example, net variance is the algebraic sum of all variances program-wide, but both favorable and unfavorable variances must be examined in depth. Both must be exploded at succeeding levels to isolate them by program segment (WBS element) and functional variance.

At the cost account level, variances are more meaningful in that they now relate to the program segment by cost category (see Figure 3). Even this is not enough. For example, a large variance in test operations may not necessarily indicate that the test is out of control. It may very well be a symptom of a problem in another area. Test cost overrun may be the result of poor materials, inadequate design, or manufacturing problems.

Cost account variance must lead to determination of the original cause. When cause is found in another functional area, variance analysis cannot stop at this point. Variance analysis in all areas where costs are incurred should reveal whether variances result from any one, or a combination, of the following factors:

- Estimates in use.
- Labor skills applied versus plan or need.
- Inadequate planning.
- Rework.
- Faulty materials.
- Increased labor rates and material costs.
- Relaxation of management discipline.
- Unforeseen requirements to meet scope of objectives.

Fundamentally, variance analysis is the highlighting of individual factors that contribute to a departure from control standards. It is an instrument for measuring progress and for estimating future requirements, based upon confirmed knowledge of behavior to date. Control cannot be exercised without knowledge of what is to be controlled, establishing control parameters and, more important, segregating the causes of variance to assist in defining updated control to remaining work. Excellent control practices may be put into effect, yet not address the real factors to be controlled. C/SCSC is intended to assure the existence of a cost/schedule control system which will assist management to better define what is out of control and, by appropriate action, to control the defined problems rather than symptoms of the problem.

In summary, C/SCSC is a criteria

FUNCTIONAL/ORGANIZATIONAL RELATIONSHIPS TO WORK BREAKDOWN STRUCTURE ELEMENTS

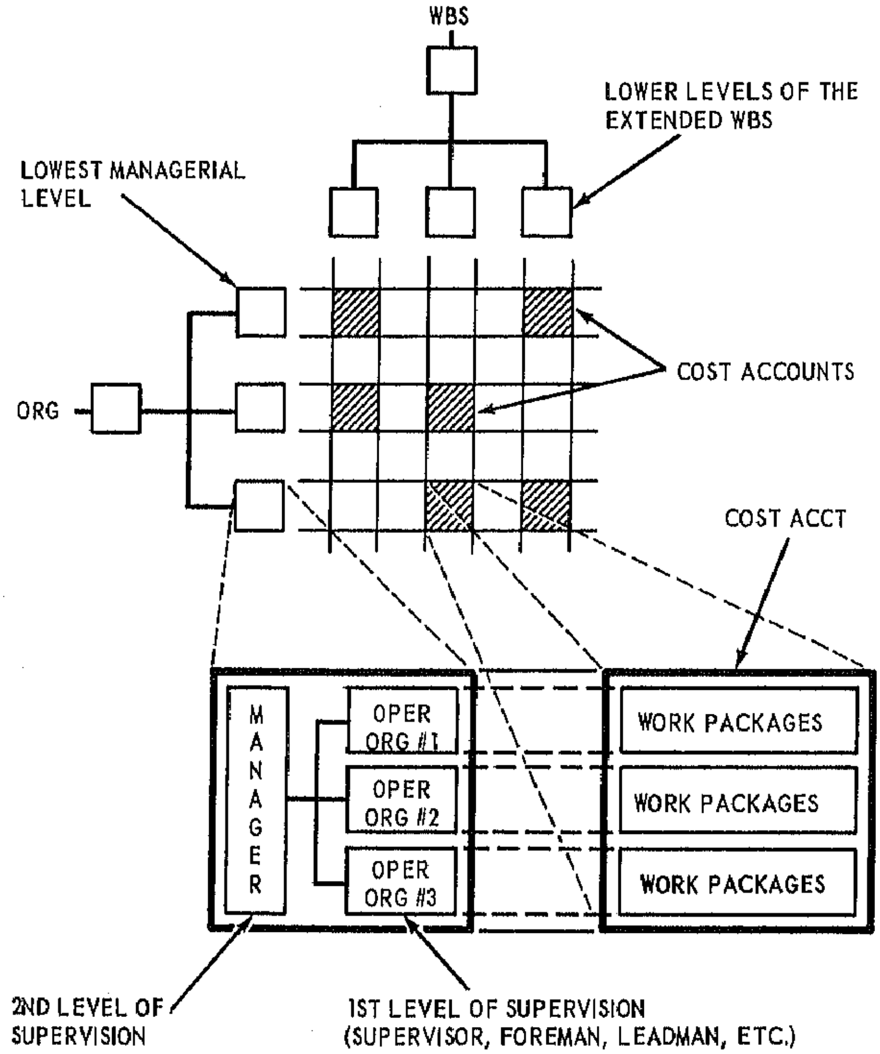

Figure 2.

TRACEABILITY

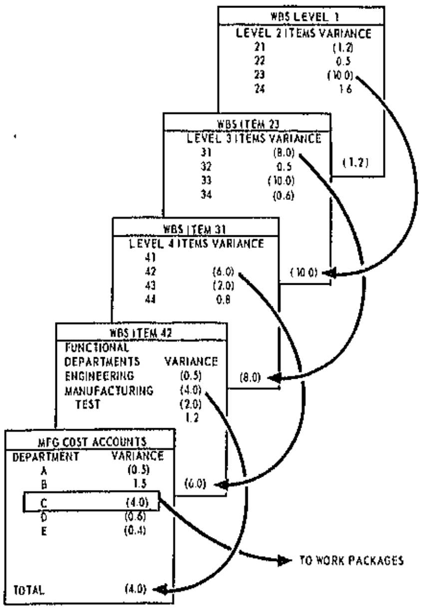

Figure 3.

or specification neither for a total cost management system, nor for a cost tracking or cost information system. It calls for a cost/schedule control system to couple these subsystems where direct and indirect relationships are known. It calls for a system to establish control requirements and a system to determine when control should be exercised and what is to be controlled.

YF–12A Flies Again for NASA-Air Force

A joint Air Force and National Aeronautics and Space Administration (NASA) research program has put the YF–12A back in the air over Edwards AFB, Calif.

Initiated last July, the project will use two Air Force YF–12As for supersonic cruise research. Under the terms of the program, NASA will budget for and fund the tests through FY 1974, at an estimated $10 million. The Air Force will supply spare parts, associated ground equipment, base support and maintenance personnel.

The test program is intended to fill a development gap left by the termination of the X–15 and XB–70 programs in early 1969. Funds from these programs were made available for the YF–12A project.

The project is divided into two phases, with the Air Force and NASA each handling one. Phase one, under Air Force control, is oriented toward seeking additional data on operational factors, development of procedures, and establishment of limitations relating to command and control problems.

NASA, in phase two, will seek altitude-hold data at supersonic speeds, and data concerning boundary layer noise, heat transfer under high speed conditions, airframe-propulsion system interactions involving effects of engine inlet performance, and handling and performance characteristics.

MBT Development Program Reoriented

Deputy Secretary of Defense David Packard has announced that the Army will reorient its Main Battle Tank (MBT) development program to reduce procurement costs, simplify operation and maintenance, and improve reliability.

The modified bi-national MBT program involves revision of the joint development relationship which the United States and the Federal Republic of Germany have had since 1963. Each country will now assume unilateral technical decisions and unilateral funding.

Exchange of information and support will continue, but now each country will also unilaterally fund materials and services it requests from the other country.

To achieve the goals of the revised program will require redesign of selected components, including the fire control, stabilization and secondary weapon systems. Specific figures on the cost reduction will not be available until final design definition, about June 1970.

The new program provides for the first U.S. production of the modified MBT in the mid-1970s.

Navy Plans Research Rocket Launches

The Naval Ordnance Missile Test Facility, White Sands Missile Range, N.M., has announced the scheduling of 80 sounding rocket firings for 1970.

More than one half of the launchings will be of the Aerobee 150, a low-cost research rocket designed to carry scientific payloads to altitudes of 70 to 190 miles. More powerful Aerobee 170 and 350 rockets, capable of reaching heights of 200 and 294 miles, respectively, with increased payloads, will account for 21 launches.

Also included in the firing schedule are 11 Nike-Apache and 2 Nike-Cajun vehicles.

The rocket launchings are conducted in conjunction with the National Aeronautics and Space Administration, the Air Force, the Naval Research Laboratory, Washington, D.C, and the Kitt Peak Observatory, Ariz. Research activities include studies of solar flares, micrometeor detection, magnetic fields, and other upper atmospheric phenomena.

Universities and other government agencies provide research criteria for the individual projects.

USAF Contracts for Beryllium Studies

The Air Force has awarded a contract to North American Rockwell Corp., Los Angeles, Calif., for an analytical and experimental investigation of advanced beryllium structures.

Objects of the program are to develop and demonstrate beryllium configurations that are capable of overcoming or reducing the brittle failure characteristic of commercially available beryllium products, especially cross-rolled sheet.

Laminating and cladding beryllium with more ductile materials will be studied, and selected configurations will be fabricated, tested and analyzed to see if they can carry complex loads and withstand impact.

The investigation is being conducted for the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio. Edward Barnett is the laboratory engineer on the project.

FROM THE SPEAKERS ROSTRUM

New Approaches in Major Weapon System Contracting

Excerpt from a speech by Hon. Philip N. Whittaker, Asst. Secretary of the Air Force (Installations and Logistics), to the Dayton, Ohio, chapter of the National Contract Management Association, Jan. 15, 1970.

* * * * *

Prior to the fall of 1968, the Air Force was engaged in formulating the concept for a new advanced tactical fighter which we then called the F-X. On Sept. 28, 1968, the Deputy Secretary of Defense approved the initiation of contract definition. Throughout concept formulation, we had been concerned about two things. One was describing the requirements for an airplane adequate to do its job into the mid-1980 time period, some 15 to 17 years later, and the other was developing a program with the necessary contractual vehicles to assure acquiring a weapon system modern and versatile enough to meet those requirements.

A request for proposal (RFP) was issued, and, in December 1968, three companies (Fairchild-Hiller, McDonnell-Douglas, and North American Rockwell) received contract definition contracts. During the contract definition period, we continued to review our experience with other programs and contracts and made changes in the F-15 contract approach based on this experience.

Just before Christmas 1969, we awarded the F-15 acquisition contract . . . to McDonnell-Douglas Corp. This contract is representative of the present trend in the system acquisition process in the Air Force. In order to reflect some of our current thinking to I would like to describe some of rincipal features of that contract.

In accordance with the contract, the F-15 will be a single-place twin-engine jet fighter designed to carry both a gun and air-to-air missiles. Development plus 20 test aircraft and the test support are included in the contract at a target price of slightly over $1.1 billion. In addition, we have production options to purchase 107 operational systems.

The F-15 procurement approach emphasizes system performance, program control, low production cost and realism of cost estimates. The contract is structured to provide the flex' bility necessary to develop a superior aircraft while controlling costs, and still provide positive incentives to do the best possible engineering job in the early stages of the program. An innovative development program, it encourages design excellence pointed toward production of a superior fighter at minimum cost.

Continuing Visibility

Milestones have been incorporated into the contract to assure that the Government has the visibility to control costs, schedules, and performance. The contractor must demonstrate successful accomplishment of defined tasks at the specified times to the government's satisfaction before production commitments are made. Certain milestone events during the performance of the contract have been established; an exhibit to the contract describes the demonstration milestones, the dates by which they will be accomplished, and the criteria for measurement. These are significant technical achievements such as preliminary and

Philip N. Whittaker is Assistant Secretary of the Air Force (Installations and Logistics). Previously he was Assistant Administrator for Industry Affairs, National Aeronautics and Space Administration. He was a vice president of International Business Machines Corp. before entering Government service. He was also a member of the Board of Advisors of the National Contract Management Association.

critical design reviews, component and subsystem demonstration tests, avionics fly-off, prototype engine tests, crew escape system tests, and the like.

If the contractor does not satisfactorily accomplish a demonstration milestone, the Government has the right to defer its commitment to the production, in whole or in part, until the milestone has been satisfactorily accomplished. In such a case, the production schedule may be (at the Air Force's option) slipped with no adjustment in contract prices or ceilings. Thus, high dollar commitments for production are avoided until there is reasonable assurance of success. Our commitments will progress only as development progresses, until development has reached a point where technological unknowns or uncertainties have been resolved or minimized. Production can then be undertaken with confidence in the basic design and demonstrated performance.

Contract Structure

To achieve system performance, program control and low production cost, and to best implement the milestone approach, the Air Force combined cost reimbursable and fixed-price contracting features into a single unique contract. The combination Cost Plus Incentive Fee/Fixed Price Incentive with Successive Targets (CPIF/FPIS) contract contains design, development and test efforts, test aircraft, production quantities for the first wing, and options for additional production lots for two more wings.

Specifically, the contract contains three parts.

Part 1 is on a CPIF basis and includes the cost of design, development test and test support. The CPIF portion reimburses the contractor for all of his costs reasonably incurred in the performance of the developmental work. It includes a minimum and maximum fee and a prenegotiated incentive cost sharing formula. A cost type contract was used to encourage technical objectives without subjecting the contractor to undue risks. It should also allow the exercise of that type of close government control envisioned.

Parts 2 and 3 of the contract are on a FPIS basis.

Part 2 includes the 20 test aircraft, test support equipment, spare parts and ground support equipment to support the test program.

Part 3 includes the first wing of 107 operational aircraft, plus technical data and handbooks and certain training equipment. Spare parts and aerospace ground equipment will be separately provisioned and priced.

Reflecting Risks

To better reflect the risks to the Government and to the contractor, fixed-price incentive provisions were used rather than the firm fixed-price type. These provisions include the opportunity for revision of target costs at relatively early points in the production phase, based on actual costs experienced, but with firm price ceilings which can only be revised downward. Each of these contract parts has its own cost incentives which operate independently. Not-to-exceed ceiling price options have been obtained for the second and third wings of operational aircraft. When we elect to exercise these options, contractual targets and revised ceilings will be negotiated with the contractor. The F–15 engines will be furnished to the airframe contractor as government-furnished property. The F–15 engine source selection is currently near completion.

Total System Performance

Not all of our lessons learned have been unhappy ones. Accordingly, we have preserved some of the arrangements used in the past and have employed them in the F–15 with refinements. Our approach to Total Systems Performance Responsibility is a case in point.

We have found that disputes frequently arise regarding responsibility for system performance where there are major items of government-furnished property. It is desirable to hold the system contractor responsible for overall performance; practically, this is not feasible unless all subsystems are contractor-furnished. Our Total System Performance Responsibility (TSPR) clause in the F–15, I believe, resolves this problem. For illustrative purposes, let us discuss the government-furnished engines.

Before source selection, each prospective airframe contractor was required to negotiate a collateral arrangement with each of the prospective engine manufacturers. The Government is not a party to these agreements. Basically, they provide that, in the event of a deficiency in the system having any relationship to the engine, the deficiency would be corrected and the costs allocated in accordance with the terms of that agreement. Of course, before the agreement is implemented, there must be evidence of the fact that the engine met the required specifications. The contracts spell out what the performance of the engine must be and the right of the system contractor to observe acceptance testing. However, once the engine has met the specifications and has passed its tests, acceptance imposes total responsibility on the system contractor. If problems crop up later, other than such things as latent defects, the system contractor's recourse is to the collateral agreement. Work done under the collateral agreement is not a basis for adjustment of any contract target or ceiling prices.

Under this arrangement, the Air Force does not become involved in the "finger pointing" arguments between the prime contractor and the engine manufacturer. This means fewer disputes, fewer directed changes, less undefinitized work effort, and the benefit of pricing this risk element in the competitive environment preceding source selection.

I believe this F–15 acquisition approach is conducive to obtaining an air superiority fighter, with the necessary capabilities, at the lowest possible cost. By coupling production releases to successful accomplishment of significant demonstrable development milestones, a positive means of controlling costs over both the CPIF development and the FPIS production portions can be better achieved.

Orderly Contract Performance

In the F-15, we are trying to proceed both in development and in production in an orderly fashion. The principal aspect of our approach is that the initial operating capability (IOC) date is no longer inviolate. When we slip our commitment to production because of unsatisfactory milestone demonstration, we are also slipping delivery dates, for production leadtime will remain constant. When, and to what extent, we commit funds to production is not based on a calendar date set forth in the contract; rather, it is a function of demonstrated technical accomplishment and risk assessment. If the contractor's development proceeds in accordance with the plan, we commence production in accordance with the contract and the IOC date will be met. If development slips, we have the right to slip production. If production slips, the IOC date slips. It's just that simple.

Funding Plan

Even in development, we have set forth an orderly funding plan which is tied into the contractor's plan. While we will pay all costs up to the total estimated cost of development, less the contractor's share, we will not revise the funding plan during the year if the contractor runs into trouble and needs more money. He must continue to work toward the demonstration of a milestone even if it means exceeding the limits of the incremental funding plan. In order for us to consider an adjustment to that plan, the contractor must furnish notice commensurate with leadtime in the budget cycle. That amounts to 17 months. In the interim, he runs the risk, in the event of termination, of not being covered for costs incurred in excess of the funding plan. We believe this approach is well calculated to surface early and realistic notice of overruns, and will induce the contractor to plan his work carefully and then work his plan during development.

On the other hand, there are risks which would be unreasonable to pass completely on to the contractor, *e.g.*, runaway inflation. . . . We have, therefore, a provision in the contract to adjust the ceiling option prices for the second and third wings for abnormal escalation. The factors we are considering are labor and material costs, and adjustment only to the ceiling price.

Room To Improve

Let it be clearly understood that what I have explained is not represented to be perfection, but only the best to date. We intend to improve our contracting as we learn more and as we acquire actual experience in the administration of the milestone concept. Also, I do not want to leave the impression that this is all that we have done, are doing, or will do. There are many other important efforts underway.

One is the use of a specification approach to systems engineering management in place of the cumbersome and costly 375-5 approach. The new Military Standard 499 has been included in the F-15 and AWACS [Airborne Warning and Control System] contracts to give us some experience with this way of requiring systems engineering. We are very interested in the results of these two trials and will, therefore, be watching the progress closely. We expect that the use of the military standard will not only be less restrictive on the contractor's efforts, but also should result in systems engineering at less cost to the Government.

Closely akin to systems engineering is the concept of integrated logistic support, embodying all the elements necessary to assure the effective and economical support of a system at all levels of maintenance for its entire life. We have long known that acquisition cost is only a fraction of the total cost of a system over its lifetime. . . .

By assuring that the support needs for new systems is adequately considered and included in the initial design and development concepts, we feel we are attacking one of our largest cost areas. These actions must be taken during the acquisition time period. Each of the competitors for the F-15 contract developed a full integrated logistic support plan for their proposals.

Another interesting trend in systems acquisition is the recurring discussions on the use of prototypes. We are searching for ways to authentically determine system performance prior to a large commitment to production and to use this determination as an aid in selecting the contractor who will do the best job for the Air Force. Prototypes may be the answer if their manufacture and testing is economical in relation to the total program. . . .

Tailored Weather Data System Planned

Custom-tailored weather data will soon be provided by a system under design by the Air Force Systems Command's Electronic Systems Division (ESD), L. G. Hanscom Field, Mass. Depending on how the modules are linked up or tied into the system, it will "tailor" information to meet various needs. For example, it will provide strike crews inflight and target weather data as well as terminal forecasts, or it will also provide weather forecast requirements, far larger and more general in scope, to a force commander for target assignments.

The new Tactical Weather System (TACWE) will be acquired by the ESD Aerospace Instrumentation Program Office. It will support Air Force tactical command and control system elements in any theater of operations, and provide needed meteorological information for contingencies such as brushfire wars, emergency airlift, and natural disasters.

Three basic modules will make up the system: meteorological facilities, teletype facsimile, and a radio intercept module. Also, in some instances, there will be a powerful radio transmitter.

Requests for proposal are expected to be sought early in 1970.

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Defense Construction Supply Center

Wire, Lumber, Repair Parts

Major General Emmett M. Tally Jr., USAF

Rolls of concertina wire and tape. Barbed wire and tape. Landing mat and T–17 membrane. Fence posts.

Although these items have been recent "best sellers," they are only 4 of the 494,000 items of military supply managed at the Defense Construction Supply Center (DCSC), at Columbus, Ohio. Since its establishment in January 1962, DCSC has been the principal source of construction material, automotive and construction equipment components and repair parts used by the Military Services.

The center, a field activity of the Defense Supply Agency (DSA), provides the Army, Navy, Air Force and Marine Corps (its customers) with common commercial type items, such as lumber and plumbing accessories, and complex repair parts for mechanical, construction, material handling, and automotive equipment, and for aircraft, ships, submarines, combat vehicles and missile systems.

Procurement and Supply Mission

Today DCSC actually "wears two hats" in the DSA logistics system. It is a DOD integrated manager—an Inventory Control Point—for the increasingly computerized management of our assigned items of supply. The other "hat," or second primary mission, is that of a storage and distribution depot. DCSC is one of seven principal storage depots in the DSA system.

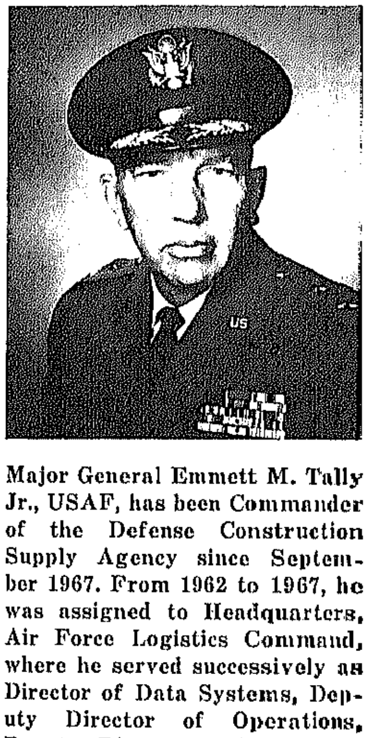
At the end of FY 1969, 791,800 DOD items in 82 Federal Supply Classes were assigned to DCSC for integrated management. Of this total, DCSC centrally manages and procures 494,000 items. Of the remaining 298,000 items, 100,100 have been authorized for local purchase by using Service activities. Some 171,600 items have been retained for management by the Services and other agencies, and approximately 26,100 items remain to be classified as to method of management.

In addition, DCSC also provides item support for the Army and Air Force overseas for non-cataloged items—those without assigned Federal Stock Numbers.

Figure 1 cites statistics reflecting DCSC activity between FY 1966 and FY 1969, in our initial primary mission—the management of Inventory Control Point operation.

In addition to purchasing the material under its cognizance as an integrated item manager, DCSC also purchases items managed by the Military Services under the DOD Coordinated Procurement Program, upon receipt of Military Interdepartmental Purchase Requests. Purchases in this program have increased steadily—from $9.1 million in FY 1964 to $106 million in FY 1968, and to $133.5 million in FY 1969.

Unique aspects of the DCSC procurement function include two offices for the purchase of lumber—one at Atlanta, Ga., and one at Portland, Ore. Lumber purchases totaled some $119.9 million during FY 1968. DCSC also buys automatic data processing equipment for all DSA ac-



Major General Emmett M. Tally Jr., USAF, has been Commander of the Defense Construction Supply Agency since September 1967. From 1962 to 1967, he was assigned to Headquarters, Air Force Logistics Command, where he served successively as Director of Data Systems, Deputy Director of Operations, Deputy Director and later as Director of Supply. General Tally holds a bachelor of laws degree from the University of Florida.

:ivities and does specialized contracting for the Defense Documentation Center.

The principal DCSC procurement objective, of course, is to buy materiel to satisfy customer demands in the most effective and economical manner. Additional objectives are to maximize competition to encourage participation of small business and firms in labor surplus areas, and to involve firms in labor surplus areas in industry-government programs for the disadvantaged.

Several methods are employed to attain these objectives. A Bidders List System is considered to be the most important. To date, more than 6,000 firms are included on the DCSC Bidders List.

Another method used is the semiannual forecast of anticipated procurements over $10,000. This is a system by which DCSC and other federal agencies submit a daily listing of all proposed unclassified procurements over $10,000 each to the Department of Commerce. These are then published in the Department of Commerce publication *Commerce Business Daily*.

During FY 1969, DCSC completed approximately 207,622 procurement actions which covered about 420,000 individual line items. Of the total procurement dollar value of $555.4 million in FY 1969, 66.8 percent was made on a competitive basis; small business awards amounted to 49.1 percent of the total dollar value of domestic awards ($506.7 million). Labor surplus/distressed area awards by preference amounted to $19.6 million. In addition to this, a program is underway to encourage the hiring of the disadvantaged by those firms in or near hard core areas of the minority population who are, or could be, doing business with the Government.

Improving Procurement Process

The most challenging activity and continually the most difficult is the procurement area. Much of the difficulty can be attributed to the lack of technical data and prior purchase data for items managed by DCSC. Many of these items are used to support old, and sometimes obsolete equipment, purchased by the Services in years past.

This situation has dictated the use of considerable manpower, on a continuous basis, in an effort to obtain the required data from either the Military Services or industry. Much progress had been made in this area, but efforts to improve procurement techniques continue.

Many actions have been taken by DCSC in this endeavor, most of which have been efforts toward broadening the knowledge of our procurement personnel. Some of these actions include:

- Collection and preservation on microfilm of information on a total of 5,000 manufacturers and their products for instant referral by procurement personnel.
- Construction and exhibition of display boards containing samples of hundreds of items of the various categories managed by the center which, also, can be referred to by employees for aid in identification of an item. These are also used by suppliers to acquaint themselves with representative DCSC-interest items.
- Continuous educational training courses conducted for DCSC personnel to improve procurement techniques and simplify procedures. The courses are conducted by industrial representatives and experts in procurement fields.

In order to keep pace with the demand for faster and more efficient processing of requisitions and speedier delivery of needed materials to the action areas, DCSC has developed and uses a large and modern computer complex. Detailed computer programs have been developed and expanded into systems which process supply requests from receipt until ultimate shipment, with a minimum of human handling.

The center has been designated as the pilot DSA center for testing and putting into use a standard Inventory Control Point system, known in DSA as the Standard Automated Materiel Management System (SAMMS). The ultimate system, however, will be the result of the combined efforts of all DSA centers and DSA headquarters, all having shared responsibilities for developing various segments of the overall system.

SAMMS became operational at DCSC in FY 1970. It is an effort to achieve uniformity in materiel management functions among the logistics elements of DSA, and perhaps ultimately throughout DOD. Success of this system will establish a means of

DCSC Activities Between FY 1966 and FY 1969

(In millions)

	FY 1966	FY 1967	FY 1968	FY 1969
Value of Inventory (in millions)	$218.0	$405.5	$485.9	$521.6
Customer Demands	2.7	3.3	3.5	4.0
Net Sales	$244.7	$517.9	$457.5	$380.2
Value of Stock Fund Procurement (For items under Cognizance of DCSC)	$574.9	$490.3	$372.8	$336.8
Overall Value of Procurement (Including Military Interdepartmental Purchase Requests from the Services)	$697.1	$670.3	$608.2	$555.4

Figure 1.

DEFENSE CONSTRUCTION SUPPLY CENTER

COLUMBUS, OHIO 43215

PHONE (614) 236 PLUS EXTENSION
(INFORMATION (614) 236-3131)

EXECUTIVE OFFICER
F M Cecil, Lt Col USAF — 2168

COMMANDER
E M TALLY JR, MAJOR GENERAL, USAF — 2166
DEPUTY COMMANDER
J H FORD JR, COLONEL USA — 2167

PERSONAL STAFF
PUBLIC AFFAIRS OFFICE
R C Guthrie — 2328
SMALL BUSINESS SPECIALIST
C Peterson — 3541

OFFICE OF COUNSEL
Counsel, D P Newton — 3284
PROCUREMENT AND PRODUCTION COUNSEL
Chief, K R Ellenberger — 3284
LITIGATION COUNSEL
Chief, J C Hubbard — 3284

OFFICE OF PLANNING & MANAGEMENT
Director, D J Clements Jr, Capt SC USN — 3241
Deputy Director, J L Kilkenny — 3242
PLANS, PROGRAMS AND ANALYSIS DIVISION
Chief, R D Hoffman, Lt Col USAF — 3276
MANAGEMENT CONTROL DIVISION
Chief, F H Whitchurch, Cdr USN — 2287
SYSTEMS AND PROCEDURES DIVISION
Chief, L Black — 2249

OFFICE OF DATA SYSTEMS
Director, A R Edsall, Jr, Capt SC USN — 2141
Deputy Director, R A Paxton — 2141
MANAGEMENT SUPPORT OFFICE
Actg Chief, C W Schneider — 2474
SYSTEMS DESIGN AND PROGRAMMING DIVISION
Chief, H R Levin, CDR SC USN — 3916
OPERATIONS DIVISION
Chief, R P Davis — 2526

OFFICE OF COMPTROLLER
Comptroller, M Floro — 3151
Deputy Comptroller, L R Lagasse Maj USA — 3151
BUDGET DIVISION
Chief, J C Bennett — 3129
ACCOUNTING & FINANCE DIVISION
Chief, R A Young — 3161
PERFORMANCE ANALYSIS & REPORTS DIVISION
Chief, D C Carlman — 3526

DIRECTORATE OF SUPPLY OPERATIONS
Director, R W Smith, Col USAF — 3121
Deputy Director, H E Davis — 3121
MANAGEMENT SUPPORT OFFICE
Chief, P R Daugherty, Lt Col USA — 2220
STOCK CONTROL DIVISION
Chief, H T Ross, CDR USN — 3840
REPAIR PARTS DIVISION
Chief, V F Williams Jr, Lt Col USA — 2189
CONSTRUCTION DIVISION
Chief, C F Wilson, Lt Col USA — 3171

DIRECTORATE OF PROCUREMENT & PRODUCTION
Director, D C Stafford, Capt SC USN — 2191
Deputy Director, D J Fisher — 2193
CONTRACT REVIEW OFFICE
Actg Chief, G J Stergar, Maj USAF — 2063
MANAGEMENT SUPPORT OFFICE
Chief, V E Jones, Lt Col USMC — 2920
OPERATIONS SUPPORT OFFICE
Chief, S J Crognale, Jr, Lt SC USN — 3543
PRODUCTION DIVISION
Chief, R G Wiggers, Lt Col USA — 2211
PROCUREMENT DIVISION I - CONSTRUCTION
Chief, D E Lovell, Cdr SC USN — 2281
PROCUREMENT DIVISION II - VEHICLE
Chief, J R Witt, Lt Col USA — 2106
SPECIAL PURCHASE (SPUR) DIVISION
Chief, C J Stowell, Jr, Maj USAF — 3246

DIRECTORATE OF TECHNICAL OPERATIONS
Director, R E Banning, Col USAF — 3251
Deputy Director, W R Earnest — 3251
MANAGEMENT SUPPORT OFFICE
Chief, J W Nail, Maj USAF — 2934
STANDARDIZATION OFFICE
Chief, W Schuhart — 3965
PROVISIONING COORDINATION OFFICE
Chief, B W Armstrong — 2231
CATALOGING DIVISION
Chief, N Lessem — 2241
QUALITY ASSURANCE DIVISION
Chief, C W Fjelsted — 3527
TECHNICAL SERVICES DIVISION
Chief, R O Miller, Lt Col USAF — 2203
TECHNICAL DATA DIVISION
Chief, J B Dollison — 2202

WOOD PRODUCTS OFFICE (DCSC)
Portland, Oregon 97208
Telephone: (503) 777-4441

Chief, J E Peters, Jr. — 288
CONTRACT REVIEW AND PROCEDURES OFFICE
Chief, F C Klopien — 395
TECHNICAL SUPPORT DIVISION
Chief, K T Lehmann — 395
OPERATIONS SUPPORT DIVISION
Chief, E G Connard — 381
PROCUREMENT OPERATIONS DIVISION
Chief, (Vacant) — 298
Chief, Purchase Branch C
G H Hammond
Wood Products Purchasing Office
Atlanta, Georgia 30303
Telephone: (404) 526-6644

DIRECTORATE OF INSTALLATION SERVICES
Director, W A Kerr, Col USMC — 3101
Deputy Director, C C Rau — 3101
OFFICE OF SAFETY AND INDUSTRIAL HEALTH
Chief, C C Rau — 3101
OPERATING MATERIEL DIVISION
Chief, S Fields, LCdr USN — 2304
ENGINEER DIVISION
Chief, R M Simpson Maj USA — 2122
SECURITY DIVISION
Chief, R S Dodge, LCdr USN — [illegible]
PROPERTY DISPOSAL DIVISION
Chief, W H Bryar — [illegible]
[illegible] DIVISION
Chief, [illegible] — [illegible]

DIRECTORATE OF STORAGE & TRANSPORTATION
Director, K A Young, Col USAF — 2251
Deputy Director, M R Greuel — 2417
MANAGEMENT SUPPORT OFFICE
Chief, R T Dorkee, Lt Col USAF — 3114
OPERATIONS CONTROL OFFICE
Chief, J E Hammond, Cdr SC USN — 3615
TRANSPORTATION AND TRAFFIC MANAGEMENT OFFICE
Chief, J W Wallace, Lt Col USA — 3221
RECEIVING DIVISION
Chief, M W Raymond — [illegible]
WAREHOUSING DIVISION
Chief, F E Begley, Lt Col USA — [illegible]
SHIPPING DIVISION
Chief, [illegible] — [illegible]

DIRECTORATE OF IPE OPERATIONS
Director, R E Benson, Lt Col USMC — 3165
Deputy Director, D Batt — 3165
OPERATIONS & PRODUCTION CONTROL OFFICE
Chief, R Tiebout — 3729
TECHNICAL & QUALITY CONTROL OFFICE
Chief, C Bennett — 3737
INDUSTRIAL PLANT EQUIPMENT STORAGE DIVISION
Chief, (Vacant) — [illegible]
REPAIR OVERHAUL DIVISION
Chief, C Baker — [illegible]

Editor's Note: Organization charts appearing in the Bulletin are edited by the editorial staff to reflect those elements of the various DoD organizations which are of interest to industry representatives. Organizational elements not required in the DoD-industry relationship have been eliminated because of space limitations.

The information on personnel and telephone numbers is as current as is possible to obtain at the time we go to press.

supply effectiveness far above anything developed thus far in the logistics field.

The "Other Hat"

In addition to its primary mission of providing effective and economical supply support to the Military Services, DCSC also is one of seven principal storage depots in the DSA integrated warehouse and distribution system. The center's storage mission is similar to a commercial warehouse operation. Large tonnages of stocks are received, stored and issued for many different owners such as the other DSA centers, Defense Industrial Plant Equipment Center, the Army, Office of Civil Defense, and General Services Administration.

During FY 1969, the DCSC Directorate of Storage and Transportation (depot organization) received 302,674 line items and shipped 2,225,493 line items. At the present time, approximately 427,000 different line items, representing approximately 198,000 tons of materiel, are stored at DCSC. These items range from small gaskets and common hardware to huge items of government-owned industrial plant equipment, such as hydraulic presses.

Unique materiels which are stored include strategic and critical materiel for the General Services Administration, such as bulk metals, and civil defense material, such as shelter supplies consisting of survival-type food, medical and sanitation kits, and water storage containers to support shelters in West Virginia, Ohio and Western Pennsylvania.

During FY 1968, DCSC, again as the pilot DSA depot, began operation of a standard computer system for mechanizing receipt processing, shipment planning, freight consolidation, shipment status, stock locator files, workload forecasting, and the preparation and control of shipment documentation.

This system permits remote inquiry (from units located in the warehouses) of the central computer located in the center's Office of Data Systems. The remote devices are used to query the main computer for "put-away" locations for items and locator data for stored items, and to process requests for additional shipping workload (which has been retained/stored in the computer).

Considerable use is made of direct access (disk packs) units to permit random file processing, as contrasted to sequential processing in a magnetic tape system. This sytem, known as the Mechanization of Warehousing and Shipment Processing (MOWASP), has been placed into operation at all DSA depots.

In addition to MOWASP, DCSC has completed the installation of a new mechanized materials handling system in the Directorate of Storage and Transportation. This highly automated system permits the unloading, processing, and moving into storage or to shipping readiness a maximum of 2,950 packages in an 8-hour period, by mechanical means (conveyors and sorting devices) with a minimum of manual handling.

Other Missions

Other DCSC basic missions include performing maintenance for industrial plant equipment, civil defense engineer-type equipment and DSA mission items, and property disposal functions for some 146 satellite activities. Industrial plant equipment (IPE) consists of the machine tools and other mechanical or electrical equipment normally used by defense manufacturing plants and military maintenance shops for heavy equipment. IPE repair and rebuild work performed by DCSC involves precision and technical operations requiring close tolerances in machining and fitting. This equipment is first operationally tested or inspected and then repaired or rebuilt, as directed by the Defense Industrial Plant Equipment Center (DIPEC) at Memphis.

During FY 1969, maintenance was performed on approximately 800 IPE items. Repaired or rebuilt items are shipped to customers.

Maintenance performed on civil defense engineer-type equipment (such as portable generators, water pumps, water purification units and related accessories) and DSA mission stocks (reparable items stored at DCSC) is basically minor repair or modifications, required prior to issuing the items to the customers.

During FY 1969, a total of 91,211 line items of excess, surplus, scrap and waste materiel, representing 15,078 short tons with an acquisition value of $60,953,518, were received by DCSC. In this same period, a total of 72,682 line items, representing 15,146 short tons with an acquisition value of $58,280,911, were disposed of. The statistics cited represent the total activity for DCSC and satellited activities.

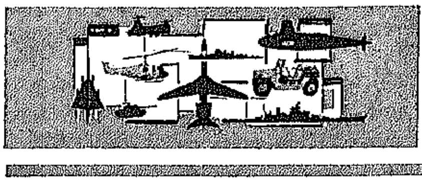
Determining Future Needs

The primary problem that we face in the future is to improve our forecasting capabilities so that we can provide our military customers the items they need, when they are needed, without building up great quantities of unusable inventories. Anyone can provide adequate support to the customer if he buys great quantities of each and every item that could ever possibly be required. This certainly is not an effective or efficient method and would waste many billions of dollars.

The normal method, used at DCSC to compute requirements, is based on an issue rate—use of past history to determine future needs. This method is supplemented by obtaining forecasts from our customers on high-dollar item needs, and by using good common sense to increase or decrease buy programs when the needs of our customers are escalating or de-escalating.

We can improve our forecasting by a more definitive categorization of our issues into the reasons for which the items were required. In determining future requirements, significant factors to be considered are whether or not issues were made to satisfy our customer's normal consumption, to fill a pipeline, or for a one-time project which will not be repetitive. We must increase our knowledge of the assets that are in the hands of our customers and the expected rate of consumption, to accurately pinpoint the customer's needs, both in quantity and timeliness.

Although we have taken some steps to achieve this goal, a program now under study will provide us more asset and consumption knowledge from our customers, so that we can provide a more efficient and responsive logistics system for less cost to the taxpayer.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of January 1970:

DEFENSE SUPPLY AGENCY

5—**Sportwelt Shoe Co.**, Nashua, N.H. $1,338,-904. 200,000 pair of men's black oxford dress shoes. Houlton, Me., and Nashua. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1260.

7—**Burlington Industries, Inc.**, New York, N.Y. $1,709,488. 954,000 linear yards of green tropical wool and polyester cloth (USMC shade 2235, type III mothproofed). Raeford, N.C., and Clarksville, Va. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1231.

9—**Vi-Mil, Inc.**, Cambridge, Mass. $1,280,563. 56,686 men's Marine Corps green wool serge overcoats. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1011.

12—**Allis Chalmers Manufacturing Co.**, Milwaukee, Wis. $1,034,884. Electric forklift trucks. Harvey, Ill. Defense General Supply Center, Richmond, Va. DSA 400-70-C-3377.

19—**J. P. Stevens and Co., Inc.**, New York, N.Y. $1,787,520. 532,000 yards of Marine Corps green wool serge cloth. Rockingham, N.C., and Greer and Wallace, S.C. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1297.

—**Burlington Industries, Inc.**, New York, N.Y. $1,003,500. 300,000 yards of Marine Corps green wool serge cloth. Raeford, N.C., and Clarksville, Va. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1296.

20—**Altama Delta Corp.**, Darien, Ga. $1,689,-548. 186,882 pairs of leather combat boots. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1076.

—**McRae Industries, Inc.**, Mount Gilead, N.C. $1,368,445. 159,926 pairs of leather combat boots. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1362.

> **CONTRACT LEGEND**
> Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

22—**Otis Elevator Co.**, Cleveland, Ohio. $2,448,-630. Forklift trucks. Defense General Supply Center, Richmond, Va. DSA 400-70-C-3557.

—**Valley Metallurgical Co., Inc.**, Essex, Conn. $1,212,312. Magnesium powder. Defense General Supply Center, Richmond, Va. DSA 400-70-C-3564.

26—**Allis Chalmers Manufacturing Co.**, Milwaukee, Wis. $2,415,660. 388 forklift trucks, 6,000 pound capacity. Defense General Supply Center, Richmond, Va. DSA 400-70-C-3593.

27—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts for wind resistant cotton and nylon sateen cloth:

Putnam Mills Corp., New York, N.Y. $1,230,000. 1,000,000 linear yards. Greenville, S.C., and Memphis, Tenn. DSA 100-70-C-1383.

J. P. Stevens and Co., Inc., New York, N.Y. $1,749,119. 1,508,000 linear yards. Piedmont and Wallace, S.C. DSA 100-70-C-1382.

30—**Burlington Industries**, Cleveland, Tenn. $1,283,202. 188,154 wool blankets for the Republic of Korea. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1409.

DEPARTMENT OF THE ARMY

2—**Scovill Mfg. Co.**, Waterbury, Conn. $1,308,-852. M219E1 grenade fuzes. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C0028.

—**Bowen-McLaughlin-York Co.**, York, Pa. $17,395,445. M-110 self-propelled, full track 8-inch howitzers; M-107 self-propelled, full track 177mm guns; and M-572 recovery vehicles. Army Weapons Command, Rock Island, Ill. DA-AF03-70-C0044.

—**Philco-Ford Corps.**, Philadelphia, Pa. $2,-500,000 (contract modification). Design and control of spare parts of classified equipment. Army Electronics Command, Ft. Monmouth, N.J. (Contract No. not available.)

—**Allied Materials & Equipment Co.**, Kansas City, Kan. $2,051,940. Cylinder assemblies for M60 tank engines. Kansas City and Wichita, Kan. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-2536.

—**Goodyear Tire & Rubber Co.**, Akron, Ohio. $1,072,710. Pneumatic tires for half-ton trucks. Tank Automotive Command, Warren, Mich. DA-AE07-70-C2461.

5—**Northwest Marine Ironworks Co.**, Portland, Ore. $1,408,975. Repairs to Engineer Corps seagoing hopper dredge. Engineer District, Portland, Ore. DA-CW57-70-C0040.

—**AVCO Corp.**, Richmond, Ind. $1,344,600 (contract modification). M-423 rocket fuze metal parts. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C0107.

6—**Appalachian Power Co.**, N.Y., N.Y. $3,-597,750. Operation of power plant to support production requirements at Radford (Va.) Army Ammunition Plant. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-11-173-AMC-134 (A).

8—**General Motors Corp.**, Indianapolis, Ind. $1,498,302. CD850-6A transmissions for the M60 tank. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-1219.

—**Jenkins Construction Co., Inc.**, Silver Spring, Md. $1,621,500. Construction of a 500-man enlisted men's barracks building, Fort Meade, Md. Army Engineer District, Baltimore, Md. DA-CA31-70-C-0022.

9—**AVCO Corp.**, Charleston, S.C. $1,800,000. Overhaul and/or repair of T-53-13/13A helicopter engines. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-A-0308.

—**Martin K. Eby Construction Co.**, Wichita, Kan. $1,841,343. Construction of the South Topeka Levee, Kansas River-Topeka Project. Army Engineer District, Kansas City, Mo. DA-CW41-70-C-0041.

12—**Emco Porcelain Enamel Co., Inc.**, Port Chester, N.Y. $2,214,675. Metal ammunition boxes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0385.

13—**Aerojet General Corp.**, Azusa, Calif. $1,-240,000 (contract modification). Modification of forward-looking, infrared airborne target acquisition and fire control systems. Frankford Arsenal, Philadelphia, Pa. DA-AA25-67-C-0471.

—**Stanford Research Institute**, Menlo Park, Calif. $1,119,418. Research and scientific studies in air defense and ballistic missile defense. Arlington, Va., and Menlo Park. Army Research Office, Arlington, Va.

14—**AVCO Corp.**, Stratford, Conn. $1,786,-440. CY 1970 program for the T-53 turbine engine. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0513.

—**Union Carbide Corp.**, New York, N.Y. $1,-172,604. Reserve power supplies for M514-A1E1 fuzes. Bennington, Vt. Harry Diamond Laboratories, Washington, D.C. DA-AG39-70-C-0026.

15—**Chamberlain Manufacturing Corp.**, New Bedford, Mass. $9,502,720 (contract modification). Metal parts for 155mm projectiles. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0075.

—**Kings Point Manufacturing Co.**, Fayetteville, N.C. $1,011,115. Clipped 5.56mm ammunition bandoliers. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0370.

—**Chrysler Corp.**, Sterling Heights, Mich. $1,-529,630. 20mm weapon system conversion kits for the M114A1 reconnaissance vehicle. Army Weapons Command, Rock Island Arsenal, Ill. DA-AF03-70-C-0048.

—The Army Aviation Systems Command, St. Louis, Mo., awarded the following contracts for maintenance support, modification, and crash/battle damage repair of aircraft, fixed and rotary winged, in South Vietnam:

Dynalectron Corp., Fort Worth, Tex. $9,532,071. DA-23-204-AMC-04022(T).

Lear Siegler, Inc., Oklahoma City, Okla. $8,228,799. DA-23-204-AMC-04023(T).

Lockheed Aircraft Corp., Midwest City, Okla. $2,416,370. DA-23-204-AMC-04024(T).

16—**General Motors Corp.**, Detroit, Mich. $3,-344,975. 1¼ ton cargo trucks and ambulances. Warren, Mich., and Baltimore, Md. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-0071.

—**Olin Corp.**, East Alton, Ill. $2,431,800 (contract modification). 5.52mm ball cartridges. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0102.

—**Ralph M. Parsons Co.**, Los Angeles, Calif. $1,783,128 (contract modification). Stand-

ard design radar site and site adaption of the design to the first Safeguard location, Grand Forks, N.D. Army Corps of Engineers, Huntsville, Ala. DA-CA87-68-C-0001.

—Ridge Instrument Co., Inc., Huntsville, Ala. $1,667,322. General calibration sets for test equipment. Army Missile Command, Redstone Arsenal, Huntsville, Ala. DA-AH01-70-C-0655.

—Federal Laboratories, Inc., Saltsburg, Pa. $1,181,537. Riot control hand grenades. Edgewood Arsenal, Md. DA-15-70-C-0206.

19—Device and Components Co., Santa Ana, Calif. $3,154,752. Support packing for 105M1 artillery shells. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0257.

20—Control Data Corp., Minneapolis, Minn. $1,091,136. Data processing feasibility study. Safeguard System Command, Huntsville, Ala. DA-HC60-70-C-0053.

22—Northrop Corp., Anaheim, Calif. $1,633,-052. Flechette warheads, WDU-4A/A. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0132.

—Action Manufacturing Co., Philadelphia, Pa. $1,043,756. Metal parts for M524 point detonating fuzes. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0101.

23—Pace Corp., Memphis, Tenn. $2,286,260 (contract modification). Trip flares. Russel and Camden, Ark., and Memphis. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0137.

—Chrysler Motor Corp., Warren, Mich. $1,-472,932. One-ton cargo trucks and ambulances. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-0106.

—Bowen-McLaughlin-York, York, Pa. $1,-318,784. 2½- and 5-ton truck armor plates. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3215.

—Galion-Amco, Inc., Galion, Ohio. $1,257,-051 (contract modification). Metal parts assembly for point detonating fuzes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0329.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Olin Corp., East Alton, Ill. $4,744,041 (contract modification). Load assemblies for 81mm projectiles. DA-AA09-70-C-0108.

Olin Corp., East Alton, Ill. $1,189,338. Time fuzes for 81mm projectiles. Marion, Ill. DA-AA09-70-C-0162.

Heckethorn Manufacturing Co., Dyersburg, Tenn. $2,186,307. Metal parts for 40mm projectiles. DA-AA09-70-C-0262.

Bell and Howell Co., Chicago, Ill. $1,-315,378 (contract modification). Metal parts for time fuzes. DA-AA09-70-C-0067.

Eastern Tool and Manufacturing Co., Belleville, N.J. $1,253,700. Metal parts for 40mm projectiles. DA-AA09-70-C-0261.

26—General Energy Systems Corp., Cenco Div., Janesville, Wis. $9,840,000. Construction of buildings, including utilities, installation of mechanical equipment and support facilities to complete work for five TNT lines. Army Ammuniton Plant, Newport, Ind. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0036.

—Chamberlain Manufacturing Co., Waterloo, Iowa. $1,002,240. Metal parts for smoke warheads, M166. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0109.

27—Wire and Metal Specialties Corp., Warren, Pa. $1,045,200. 5.56mm clip cartridges for M-16 rifles. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0417.

—Associated Spring Corp., Bristol, Conn. $1,500,700. 5.56mm cartridge clips for M-16 rifles. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0418.

—Teledyne Industries, Inc., Muskegon, Mich. $1,327,950. Cylinder assemblies for M48 tank engines. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3019.

—Marathon Battery Co., St. Paul, Minn. $1,003,500. BA-43801/PRC-25 dry batteries, engineering samples and high and low temperature testing equipment. Procurement Division, Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-1384.

—Bell Aerospace Corp., Fort Worth, Tex. $1,336,440. Aircraft heater kits. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-A-0314.

28—Allis Chalmers Manufacturing Co., York, Pa. $4,472,960. Manufacture and installation of three generators for the Dworshak Dam and Reservoir Project, Clear Water County, Idaho. Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0057.

—Levinson Steel Co., Pittsburgh, Pa. $4,-372,010. Metal parts for 105mm high explosive projectiles, M-1. Hays Army Ammunition Plant, Pittsburgh. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0023.

—Honeywell, Inc., Hopkins, Minn. $1,348,-593 (contract modification). Fuzes (M219-E1). DA-AA09-70-C-0027. $3,852,074. XM224 bomb fuzes. DA-AA09-70-C-0012. Army Ammunition Procurement and Supply Agency, Joliet, Ill.

—Pace Corp., Memphis, Tenn. $2,358,417. Ground illuminating parachute signals (M127A1). Camden, Ark., and Memphis. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0381.

—Chrysler Outboard Corp., Hartford, Wis. $7,435,993. Military standard engines, 1½, 3 and 6 hp. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-69-C-3413.

—Resdel Engineering Corp., Arcadia, Calif. $3,718,325. Electronic components for use in a classified system. Procurement Division, Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0128.

29—Uniroyal, Inc., New York, N.Y. $13,684,-011 (contract modification). Support services and explosives production, Army Ammunition Plant, Joliet, Ill. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-11-173-AMC-00062(A).

—Olin Mathieson Chemical Corp., East Alton, Ill. $6,558,795 (contract modification). M6, M1, M8A1, M90A1 and M67 propellant, and loading, assembling and packing propellant charge assemblies. Charlestown, Ind. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0148.

—Hamilton Watch Co., Lancaster, Pa. $6,-097,000. AN/PRC-77 radio sets and receiver transmitters, RT841/PRC-77. Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-4412.

—Bulova Watch Co., Inc., Valley Stream, N.Y. $2,012,539. Metal parts for fuzes, M524A5, for 81mm high explosives. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0100.

—Gulf Western Industries, Inc., Orlando, Fla. $5,041,311. Metal parts for point detonating fuzes, M551. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0103.

—Olin Corp., New Haven, Conn., $2,475,900. 5.56mm ball cartridges, M193. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0344.

—IBM Corp., Gaithersburg, Md. $1,349,027. Preliminary ballistic missile defense software development program. Safeguard Systems Command, Huntsville, Ala. DA-HC60-70-C-0052.

30—Fairchild Camera and Instrument Corp., Copiague, N.Y. $2,547,000. Artillery proximity fuzes, M514A1E1. Harry Diamond Laboratories, Washington, D.C. DA-AG39-70-C-0027.

—Hamilton Watch Co., Lancaster, Pa. $6,-424,080. Mk 15 Mod 0 rear-fitting safety devices for artillery fuzes. Harry Diamond Laboratories, Washington, D.C. DA-AG39-70-C-0032.

—Eastman Kodak Co., Rochester, N.Y. $1,-006,440. Rear-fitting safety devices for artillery fuzes. Harry Diamond Laboratories, Washington, D.C. DA-AG39-70-C-0033.

—Gentex Corp., Carbondale, Pa. $1,650,144 (contract modification). Pilot's protective helmets. Army Procurement Agency, New York, N.Y. DA-AG25-69-C-0881.

—Great Lakes Dredge and Dock Co., New Orleans, La. $2,524,400. Dredging of shoal material from the Mississippi River gulf outlet channel. Plaquemines Parish, La. Army Engineer District, New Orleans, La. DA-CW29-70-C-0136.

—Western Electric Co., Inc., New York, N.Y. $1,295,319 (contract modification). FY 1970 task and skill analysis for Safeguard training. Safeguard Systems Command, Huntsville, Ala. DA-HC60-69-C-0010.

—Bell Aerospace Corp., Fort Worth, Tex. $5,000,000. AH-1G helicopters. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0235.

—Kaiser Jeep Corp., Toledo, Ohio. $2,010,-914. 5-ton trucks, XM809 series. South Bend, Ind. Army Tank Automotive Command, Warren, Mich. DA-AE06-69-C-0009.

—The Army Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Airport Machining Corp., Martin, Tenn. $1,188,000 (contract modification). High explosive projectiles, M49A3. DA-AA09-70-C-0079.

Federal Cartridge Corp., Minneapolis, Minn. $53,219,044 (contract modification). Operation of Twin Cities Army Ammunition Plant, New Brighton, Minn., and related support services. DA-36-038-AMC-01099(A).

Harvey Aluminum Sales, Inc., Torrance, Calif. $38,902,367 (contract modification). Loading, assembling and packing medium caliber ammunition and related components, and for support services and operation of the Army Ammunition Plant, Milan, Tenn. DA-11-173-AMC-00520(A).

Day and Zimmerman, Inc., Philadelphia, Pa. $25,271,159. Tracers, detonators and boosters, Lone Star Ammunition Plant, Texarkana, Tex. DA-11-173-AMC-00114(A).

General Motors Corp., Indianapolis, Ind. $1,367,100 (contract modification). 81mm projectiles, M374/A1. Cleveland, Ohio. DA-AA09-70-C-0058.

Flinchbaugh Products, Inc., Red Lion, Pa. $6,397,578. Metal parts for 105mm projectiles. DA-AA09-70-C-0272.

Westclox Div., General Time Corp., LaSalle, Ill. $1,501,000 (contract modification). MSTQ fuzes, M564. Peru, Ill. DA-AA09-70-C-0216.

Donovan Construction Co., New Brighton, Minn. $9,404,320. Metal parts for 155mm high explosive projectiles, M107. Twin Cities Army Ammunition Plant. DA-AA09-70-C-0085.

—Raytheon Co., Andover, Mass. $4,449,903 (contract modification). Engineering services for the improved Hawk missile system. Bedford and Andover, Mass., and White Sands Missile Range, N.M. DA-AH01-70-C-0195. $1,322,368. Battery sets for retrofit of basic Hawk missile equipment. Fort Bliss, Tex., and Andover. DA-AH01-70-C-0615. Army Missile Command, Huntsville, Ala.

—Raytheon Co., Bristol, Tenn. $2,448,000. Artillery proximity fuzes, M514A1E1. Harry Diamond Laboratories, Washington, D.C. DA-AG39-70-C-0028.

DEPARTMENT OF THE NAVY

5—Singer-General Precison, Inc., Binghamton, N.Y. $9,966,875. F-4J weapon system trainers with support items to train pilots. Binghamton and Sunnyvale, Calif. Naval Training Device Center, Orlando, Fla. N61339-69-C-0174.

—Lockheed Electronics Div., Lockheed Aircraft Corp., Plainfield, N.J. $7,193,569. Mark 86 computer-oriented gun fire control systems. Naval Ordnance Systems

Command, Washington, D.C. N00017-70-C-4204.

—Grumman Aerospace Corp., Bethpage, N.Y. $6,000,000 (contract modification). Long lead time effort and material for FY 1970 procurement of EA-6B aircraft. Naval Air Systems Command, Washington, D.C. N00019-67-C-0078.

—North American Rockwell Corp., Los Angeles, Calif. $4,352,885. CT-39E multi-engine aircraft. St. Louis, Mo., and Los Angeles. Naval Air Systems Command, Washington, D.C. N00019-70-C-0318.

—Southern Stevedoring Corp., Norfolk, Va. $2,990,924. CY 1970 stevedoring services for Naval Supply Center, Norfolk. Naval Supply Center, Norfolk, Va. N00189-69-D-0238.

—Singer-General Precison, Inc., Little Falls, N.J. $2,508,800. Test equipment for production of ASN-84 navigation systems for P-3C aircraft. Navy Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3201-0232.

—Systems Consultants, Inc., Washington, D.C. $1,054,198. Studies to formulate test plans and procedure systems for classified electronic equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1129.

—Meadowgold Dairies, Honolulu, Hawaii. $1,099,131. Dairy products for the Navy. Naval Supply Center, Pearl Harbor, Hawaii. N00604-70-D-0227.

6—Sanders Associtaes, Inc., Nashua, N.H. $5,000,000. Manufacture of electronic equipment. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-2536.

9—ESB Corp., Exide Power Systems, Inc., Philadelphia, Pa. $5,624,891. Submarine batteries, spare parts and repair equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5328.

—Collins Radio Co., Cedar Rapids, Iowa. $3,084,000. Submarine emergency communication transmitters. Naval Electronics Systems Command, Washington, D.C. N00039-70-C-1504.

—McDonnell Douglas Corp., St. Louis, Mo. $2,000,000 (contract modification). Long lead time effort and material for RF-4E mobile training set and support equipment for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-68-C-0495.

13—Systems Engineering Laboratories, Fort Lauderdale, Fla. $1,184,943. Automatic data processing systems, Model 810A. Naval Research Laboratory, Washington, D.C. N00173-70-C-0431.

14—The Naval Air Systems Command, Washington, D.C., awarded the following contract modifications:

Lockheed Aircraft Corp., Burbank, Calif. $10,830,623. Long lead time effort and material in support of FY 1970 P-3C aircraft procurement. N00019-69-C-0237.

United Aircraft Corp., East Hartford, Conn. $7,168,000. J-52-P-408 engines and spares for A-4M aircraft. N00019-67-C-0182.

McDonnell Douglas Corp., Long Beach, Calif. $5,247,000. Long lead time effort in support of FY 1970 TA-4J/A-4M aircraft procurement. N00019-67-C-0170.

Ryan Aeronautical Co., San Diego, Calif. $2,850,000. BQM-34E/F aerial target system for the Navy and Air Force. N00019-69-C-0693.

—Lasko Metal Products, Inc., West Chester, Pa. $1,383,840. Missile shipping and storage containers. Naval Air Systems Command, Washington, D.C. N00019-70-C-0316.

15—Grumman Aerospace Corp., Bethpage, N.Y. $110,621,807. F-14A weapon system. Naval Air Systems Command, Washington, D.C. N00019-69-C-0422.

16—The Naval Air Systems Command, Washington, D.C., awarded the following contract modifications:

Lockheed Aircraft Corp., Burbank, Calif. $40,000,000. S-3A weapon system. N00019-69-C-0385.

Grumman Aerospace Corp., Bethpage, N.Y. $20,000,000. E-2C aircraft. N00019-68-C-0542.

General Dynamics Corp., Pomona, Calif. $4,500,000. Standard ARM missiles for the Navy and Air Force. N00019-69-C-0336.

—Vitro Corp. of America, Silver Spring, Md. $11,974,600. Systems engineering and supporting services for the Surface Missile Systems Project Director. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-4417.

—Pennsylvania State University, University Park, Pa. $5,270,000. Research and development in naval weapons systems, and technical direction of the Mk 48 Mod 0 torpedo. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1407.

—International Telephone and Telegraph, Paramus, N.J. $1,250,000. Programming services to develop, produce, deliver and maintain computer systems programs for the Fleet Computer Programming Center, Atlantic, Damneck-Virginia Beach, Va. Naval Purchasing Office, Washington, D.C. N00600-70-D-0541.

19—North American Rockwell Corp., Columbus, Ohio. $11,875,200. T-2C aircraft and related supplies and services. Naval Air Systems Command, Washington, D.C. N00019-70-C-0144.

—Raytheon Co., Portsmouth, R.I. $10,537,788. Submarine sonar, related equipment and engineering services. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1170.

—FMC Corp., Minneapolis, Minn. $7,915,416. 5 inch 54 caliber gun mounts, Mk 45 Mod 0. Naval Ordnance Systems Command, Washington, D.C. N00017-68-C-4211.

—Sperry Rand Corp., Great Neck, N.Y. $6,382,002. Repair parts for Mk 3, Mods 6 and 7, Ships Inertial Navigation System (SINS). Ships Parts Control Center, Mechanicsburg, Pa. N000104-68-A-0009.

—TRW, Inc., Washington, D.C. $6,157,984. Property and services to perform system analysis, integration analysis, engineering support, technical management support and engineering laboratory experimentation for the Anti-Submarine Warfare System Project. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1409.

—Sylvania Electric Products, Inc., Needham Heights, Mass. $4,684,000. Marine tactical data systems trainers, 15A19. Naval Training Device Center, Orlando, Fla. N61339-70-C-0105.

—Kaman Aircraft Corp., Bloomfield, Conn. $4,438,147. Conversion of UH-2A/B helicopters to UH-2C configuration, including progressive aircraft rework. Naval Air Systems Command, Washington, D.C. N00019-70-C-0051.

—General Electric Co., Cincinnati, Ohio. $3,897,013. Retrofit kits for J-79-GE10 aircraft engines. Naval Aviation Supply Office, Philadelphia, Pa. F34601-69-A-1020.

—Sterling Laboratories, Westlake Village, Calif. $1,490,511. AN/TXQ-3 radar data relay sets. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3527.

—Sperry Rand Corp., Syosset, N.Y. $1,216,000. Engineering services for the technical assistance program, SSBN 598 USS George Washington-class fleet ballistic missile submarine second overhaul implementation. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5340.

20—Raytheon Co., Oxnard, Calif. $2,671,782. Inspect, service, repair and furnish necessary maintenance on F-4 aircraft weapon systems. Point Mugu, Calif., and Oxnard. Naval Purchasing Office, Los Angeles, Calif. N00123-70-C-0436.

—Applied Physics Lab., University of Washington, Seattle, Wash. $2,076,000. Continuation of research, development, operation and maintenance for torpedo exploders and targets, oceanography, transducers and electrochemical studies. Naval Ordnance Systems Command, Washington, D.C. NOw 65-0207-D.

21—McDonnell Douglas Corp., St. Louis, Mo. $27,200,000 (contract modification). Long lead time effort and materials for F-4J, F-4E and RF-4E aircraft for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-68-C-0495.

22—Philco-Ford Communication and Technical Services, Fort Washington, Pa. $1,876,557. Restoration and conversion of radar repeater equipment. Norfolk, Va. Naval Ship Systems Command, Washington, D.C. N00024-70-D-1204.

23—Whittaker Corp., Saugus, Calif. $7,547,963. Aircraft parachute flares. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A071.

—Raytheon Co., South Lowell, Mass. $3,902,800. Guidance and control groups for Sidewinder missiles. Naval Air Systems Command, Washington, D.C. N00019-70-C-0269.

—Kilgore Corp., Toone, Tenn. $3,090,804. Aircraft parachute flares. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A070.

26—University of Alaska, College, Alaska. $1,341,700. Research on cold weather problems in the Arctic. Office of Naval Research, Washington, D.C.

—LTV Aerospace Corp., Dallas, Tex. $1,000,000 (contract modification). Development of interface between A-7 aircraft avionics and Versatile Avionics Shop Test (VAST) systems. Naval Air Systems Command, Washington, D.C. N00019-69-C-0536.

29—RCA, Princeton, N.J. $5,111,281. Three Navy navigation satellites. Naval Strategic Systems Project Office, Washington, D.C. N00030-69-0213.

—Raytheon Co., Sudbury, Mass. $2,136,000. Engineering support for Polaris and Poseidon guidance system electronic assemblies. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-0128.

30—United Aircraft Corp., Hartford, Conn. $20,400,000 (contract modification). FY 1970 procurement of TF-30-P-100 engines for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-67-C-0332.

—Dayton T. Brown, Inc., Bohemia, N.Y. $1,204,196. Preproduction lot sample testing of armament and survival equipment. Naval Air Systems Command, Washington, D.C. N00019-70-C-0320.

—Campbell Machine, Inc., San Diego, Calif. $1,195,518. Regular overhaul of USS Cleveland, LPD 7. Supervisor of Shipbuilding, Conversion and Repair, 11th Naval District, San Diego, Calif. N62791-70-B-0407.

—Ordnance Research Lab, Pennsylvania State University, University Park, Pa. $1,670,000. Additional support for the Mk 48 torpedo program. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1407.

—Litton Systems, Inc., Van Nuys, Calif. $2,000,271. Air Operational Central, system, AN/TYZ-2. Hq., Marine Corps, Arlington, Va.

DEPARTMENT OF THE AIR FORCE

2—Goodyear Aerospace Corp., Litchfield, Park, Ariz. $5,522,101. Components for radar equipment for reconnaissance aircraft. Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0170.

—Westinghouse Electric Corp., Baltimore, Md. $15,000,000. Electronic countermeasure pods, spares, engineering services and data. Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0588.

—Thiokol Chemical Corp., Bristol, Pa. $21,188,000. Production of Stage I motors for Minuteman III missiles. Brigham City, Utah. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0197.

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5—Thiokol Chemical Corp., Bristol, Pa. $2,700,000 (contract modification). Long lead time hardware for FY 1971 production of Stage I Minuteman III motors. Brigham City, Utah. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0197.

—McDonnell Douglas Corp., Long Beach, Calif. $1,200,000 (contract modification). Spare parts for bomb release units applicable to F-111 aircraft. Torrance, Calif. Warner Robins Air Materiel Area, AFLC Robins AFB, Ga. F33657-68-C-1247.

6—General Electric Co., Cincinnati, Ohio. $42,694,040. Production of TF-39 turbofan aircraft engines. F33657-15003. $2,000,000. Improvement of component parts of J-79 aircraft engines. F33657-70-C-0063. Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio.

—Lockheed Aircraft Corp., Sunnyvale, Calif. $2,455,270. Advanced data system for the satellite control facility. Air Force Satellite Control Facility, Los Angeles, Calif. F04695-67-C-0176.

—Honeywell, Inc., St. Petersburg, Fla. $5,347,045. Gyro accelerometers. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0243.

8—Fairchild Hiller Corp., St. Augustine, Fla. $1,740,806. Inspection, repair as necessary, and modification of C-130 aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-1542.

9—General Dynamics Corp., Fort Worth, Tex. $1,125,000. Spare parts for F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33657-13403.

—Lockheed-Georgia Co., Marietta, Ga. $100,000,000. Run A C-5A aircraft production. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33(657)-15053.

12—Lockheed Aircraft Corp., Marietta, Ga. $11,278,070. C-5A aircraft spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33657-15053.

—The Boeing Co., Seattle, Wash. $1,050,000. Study of the feasibility of a mobile capability for the Minuteman weapon system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0139.

—Philco-Ford Corp., Palo Alto, Calif. $1,005,013. Satellite control network. Hq., Air Force Space Control Facility, Los Angeles Air Force Station, Calif. F04701-68-C-0080.

13—Radiation, Inc., Melbourne, Fla. $2,356,000. Development and production of airborne communication equipment. Palm Bay, Fla. Electronics Systems Division, AFSC, L.G. Hanscom Field, Mass. F19628-69-C-0159.

14—Ryan Aeronautical Co., San Diego, Calif. $1,500,000. Design and develop target drone and related aeropace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0306.

—The Boeing Co., Wichita, Kan. $1,463,012. Maintenance of B-52 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-C-3987.

—Hughes Aircraft Co., Culver City, Calif. $1,298,900. Electronic countermeasure equipment for the F-4E aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F04606-69-A-0229.

—Fairchild Hiller Corp., Germantown, Md. $1,038,000. Design and development of electronic equipment for interpreting reconnaissance aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1295.

15—Bell Aerospace Corp., Buffalo, N.Y. $7,000,000. Post boost propulsion subsystem for Minuteman III. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0193.

—Hughes Aircraft Co., Culver City, Calif. $1,484,160. Test equipment and related spare parts for the Falcon missile. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-0265.

—Lear-Siegler, Inc., Santa Ana, Calif. $1,297,658. Air conditioning equipment and related spare parts for the F-104 aircraft. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. F04606-70-C-0587.

16—Cessna Aircraft Co., Wichita, Kan. $1,760,036. 0-2A aircraft, spare parts and related aerospace ground equipment. Aeronautical System Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0218.

20—Aerodex, Inc., Miami, Fla. $5,582,555. Overhaul of R-4360 series engines and component parts. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-70-C-0900.

21—North American Rockwell Corp., Los Angeles, Calif. $2,605,000. Reconditioning and modification of F-100A aircraft. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. F04606-70-C-0604.

—Massachusetts Institute of Technology, Cambridge, Mass. $1,800,000. Basic research in the properties of matter in intense magnetic fields. Office of Scientific Research, Arlington, Va. F44620-67-C-0047.

—Control Data Corp., Minneapolis, Minn. $1,000,000. Computer maintenance and support services. Sunnyvale and Santa Monica, Calif. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0362.

23—The Boeing Co., Wichita, Kan. $1,631,126. Engineering services for the B-52 weapon system. Oklahoma Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-0810.

26—General Electric Co., Cincinnati, Ohio. $3,550,000. Engineering development of engines for F-14B and F-15 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, F33657-69-C-0061.

27—Lockheed Aircraft Corp., Marietta, Ga. $13,769,760. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF 33(657)-15053.

—General Dynamics Corp., Fort Worth, Tex. $9,505,077. Aerospace ground equipment for F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF 33(657)-13403.

—Curtiss-Wright Corp., Wood-Ridge, N.J. $1,890,131. Spare parts for J-65 aircraft engines. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-69-A-0057.

—General Electric Co., Burlington, Vt. $1,406,493. Ammunition storage drums used in aircraft gun systems. Armament Development Test Center, Eglin AFB, Fla. F08635-70-C-0205.

28—McDonnell Douglas Corp., St. Louis, Mo. $1,101,400. Aerospace ground equipment and spare parts for F-4 aircraft. Robertson, Mo. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F34601-69-A-2245.

29—Scope, Inc., Reston, Va. $2,200,000. Development of an electronic counter-measure system. Falls Church, Va. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0709.

—AVCO Corp., Everett, Mass. $1,093,796. Re-entry physics research. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0128.

30—Curtiss-Wright Corp., Wood Ridge, N.J. $1,048,756. Spare parts for J-65 aircraft engines. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-69-A-0057.

—Williams Research Corp., Walled Lake, Mich. $1,447,200. Development of a small jet engine for decoy missiles. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0570.

OFFSHORE

5—Canadian Commercial Corp., Ottawa, Ont. $6,997,396 (contract modification). T400-CP-400 engines and special support equipment for Navy and Air Force. Quebec. Naval Air Systems Command, Washington, D.C. N00019-69-C-0125.

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TECOM Makes Organization Changes

The Army Test and Evaluation Command, Aberdeen Proving Ground, Md., has undergone organizational changes to improve its management and functional control.

Created under the change is the Test Systems Analysis Directorate (TSAD), headed by Colonel Vitaly Kovalesky, formerly director of infantry materiel.

The Plans and Operations Directorate, headed by Colonel Cornelius J. Molloy Jr., was redesignated the Test Operations Directorate, and its Methodology and Instrumentation Divisions were reassigned to TSAD.

Staff changes include: Brigadier General Michael Paulick became Chief of Staff in addition to Deputy Commanding General; Colonel Warren D. Hodges was named Deputy Chief of Staff, Support; and Colonel William H. Hubbard is now Deputy Chief of Staff, Test and Evaluation.

Project Blue Book UFO Studies Ended

Secretary of the Air Force Robert C. Seamans Jr. has terminated Project Blue Book, the Air Force program for the investigation of unidentified flying objects (UFOs). The decision to discontinue UFO investigation was based on:

- Evaluation of a University of Colorado report, "Scientific Study of Unidentified Flying Objects."
- Review of the University of Colorado report by the National Academy of Sciences.
- Past UFO studies.
- Air Force experience in investigating UFO reports during the past two decades.

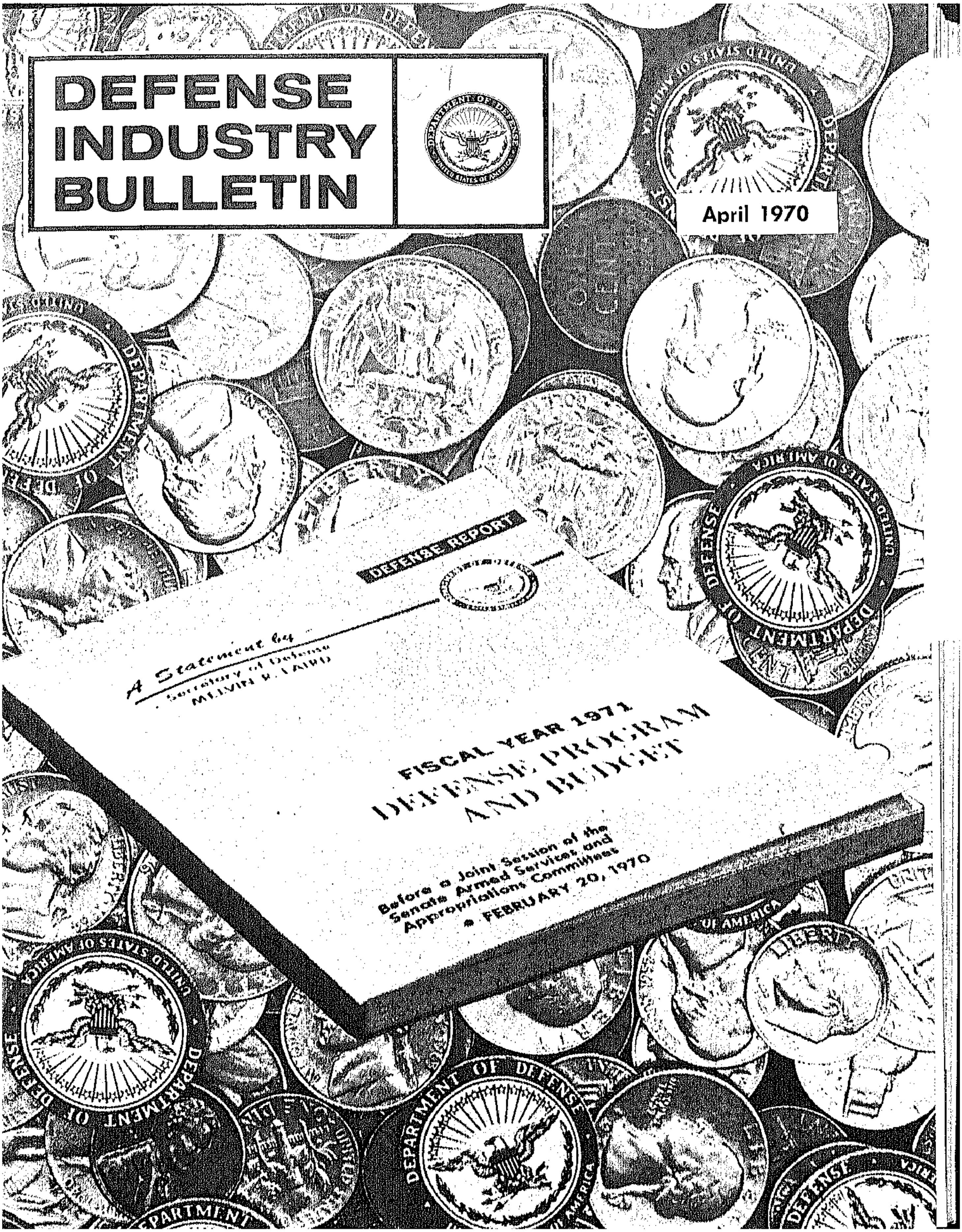
The University of Colorado report, released in January 1969, concluded that little, if anything, has come from the study of UFOs in the past 21 years that has added to scientific knowledge, and that further extensive study of UFO sightings is not justified in the expectation that science will be advanced.

In an independent assessment of the scope, methodology and findings of the University of Colorado report, a panel of the National Academy of Sciences concurred with the university's recommendation. The panel further stated that, "on the basis of present knowledge, the least likely explanation of UFOs is the hypothesis of extraterrestrial visitations by intelligent beings."

Project Blue Book records will be retired to the U.S. Air Force Archives, Maxwell AFB, Ala. Requests for information will continue to be handled by the Office of Information, Office of the Secretary of the Air Force, Washington, D.C. 20330.

DEFENSE INDUSTRY BULLETIN

April 1970



DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 4 **April 1970**

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq, Defense Supply Agency (DSAH-B), Alexandria, Va. 22314.

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DEPARTMENTS

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The Secretary's Summary

[Editor's Note: This issue of the *Defense Industry Bulletin* is devoted almost entirely to a condensation of the statement by Secretary of Defense Melvin R. Laird on the FY 1971 Defense Program and Budget, delivered on Feb. 20, 1970, to a joint session of the Senate Armed Services Committee and the Senate Subcommittee on Department of Defense Appropriations.

An attempt has been made to include those portions of the statement that are of special interest to defense industry. In its original format, the statement contained five appendices. As presented in the *Bulletin*, these appendices have been rearranged to immediately follow the subject areas to which they pertain.

The complete text of this statement is available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.50.]

When we assumed office, I expressed the hope that my success or failure as Secretary of Defense would be judged on whether or not we in the Nixon Administration restored peace and were able to maintain it.

As we reduce our defense spending and move further into negotiations, we should have no illusions about the current state of world affairs. I am obliged to report to you, for example, that the Soviet Union is not making similar reductions in its defense budget. In fact, the Soviet Union is pulling abreast of us in many major areas of military strength and ahead of us in others. The Soviets are continuing the rapid deployment of major strategic offensive weapon systems at a rate that could, by the mid-1970s, place us in a second-rate strategic position with regard to the future security of the Free World.

Following the exploratory arms limitation talks in Helsinki, the Soviet Union has agreed to discuss the limitation of strategic weapon systems with us in Vienna beginning in April. Hopefully, success in the Strategic Arms Limitation Talks (SALT) will move both our nations well along the road toward the era of uninterrupted peace we all seek. The dividends for our domestic programs could thereby be increased still further.

However, as Secretary of Defense, I must consider actions as well as words. If the current Soviet buildup continues, we will need additional costly steps to preserve an effective deterrent. Pending the outcome of SALT, we must continue those steps which are necessary to preserve our current strategic position. Within that context, this austere FY 1971 budget is designed to preserve the range of options we may need for possible outcomes of the talks, including those we may need if no agreement is reached and Soviet strategic deployments continue at or above the present levels.

The rate of buildup of the Soviet threat and the long lead time needed to develop and deploy operational systems make it essential that we continue progress on the Safeguard antiballistic missile defense system and initiate a further increment of that system in FY 1971. Without the Safeguard increment provided by this budget, we would have to face hard decisions about adding to our offensive systems in this transition year, rather than being able to await hoped-for progress in SALT and the development of a new five-year program which will be presented next year.

In my view, the President's decision to go forward with a modified phase II of the defensive Safeguard program will, in the long run, enhance the prospects for the success of SALT because, in the short run, it allows us to exercise greater restraint in matching a continued Soviet buildup of offensive systems with actions involving our own offensive systems. Safeguard has the added advantage of doing this with minimal spending in FY 1971.

The President's decision on Safeguard is also essential to preserve our capability to deter Chinese nuclear

aggression against our Asian allies without jeopardizing the U.S. civilian population.

In this, my first comprehensive report to the Congress since Deputy Secretary David Packard and I took office in January 1969, I intend to set forth the Defense Department program and budget for FY 1971, and the reasons that compel us to follow a transitional course in this first year of a decade which historians will probably view as one of world transition.

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Approach to FY 1971 Defense Program and Budget

The programs we are proposing for FY 1971 are essentially designed to preserve our own military capabilities and flexibility during the transition period financed by the FY 1971 defense budget. We have made no irrevocable decisions on the future composition of our strategic, general purpose, or mobility forces. We know that under any kind of sensible national security program, we will need major portions of the forces that are already in existence. The precise mix of those forces depends on many uncertain factors; some of them are subject to our control, others are outside our influence. SALT and the Paris Peace Talks are the most obvious factors that contribute to this uncertainty. Other factors include:

- Progress of our Vietnamization policy.
- Need for detailed consultations with our allies.
- Need to conclude additional wide-ranging studies on such matters as the balance of forces between NATO and the Warsaw Pact.

During the coming year, we will continue to review what adjustments in military strength will be required for ourselves and our allies to make our new strategy effective. Many of these adjustments will be reflected in our five-year defense program next year.

. . . a number of significant changes are being made in our Planning-Programming-Budgeting System (PPBS) procedures and, although we have not found it feasible in this Defense Report to project our proposed forces and programs beyond FY 1971, we have already started the FY 1972–76 PPBS cycle. We confidently expect to be in a position next year to present to the Congress our proposed five-year defense program.

An important change under the new PPBS concerns the role of the Joint Chiefs of Staff (JCS) and the Services. In contrast to the practice of the preceding Administration, we are now providing the JCS and the Services explicit strategy and fiscal guidance, prior to the submission of their final force recommendations for the forthcoming five-year program and annual budget. In the past, they were placed in a position where they had to submit their force recommendations without reference to any explicit fiscal guidance. This, in large part, explains why, in the past, the JCS proposals always cost $20 to $30 billion more than the annual defense budgets recommended by the Secretary of Defense and approved by the President.

Pending the full implementation of the new PPB System, which will be completed this year, we have had to adopt some interim arrangements for the development of the FY 1971 defense program and budget. It became evident by the late summer of last year that major reductions would have to be made in the FY 1970 budget, and that the conditions which made these reductions necessary would also affect the FY 1971 budget. Those conditions included:

- Determination of President Nixon to reorder our allocation of Federal resources to bring them in line with changing national priorities.
- Crucial need to bring inflation under control and the President's dedication to this objective.
- Clear intent of Congress to make major reductions in defense spending.

Therefore, we modified the FY 1971 segment of the previously approved five-year defense program to reflect all adjustments the Department and Congress were expected to make in the FY 1970 budget. We then estimated the cost of the modified FY 1971 program. . . .

[The Services'] budget estimates were reviewed jointly by my staff and the Bureau of the Budget staff, as has been the practice for many years. The force changes were reviewed by the Joint Chiefs of Staff and by elements of my own staff. [Deputy Secretary] Packard and I, in full consultation with all of our principal military and civilian advisors, then reviewed the outstanding issues and made final decisions on our FY 1971 program and budget recommendations.

These recommendations, plus those of the Defense Program Review Committee on major issues involved in the FY 1971 defense program and budget, were submitted directly to the President. The President, of course, made the final decisions.

The FY 1971 defense budget transmitted to the Congress by the President totals $71.3 billion in new obligational authority (NOA) and $71.8 billion in outlays, excluding any pay increases that may be enacted by the present session of the Congress. . . .

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Given a sufficiently tranquil world, the Defense Department's objective in the 1970s concerning fiscal matters will be to keep defense spending at such a level that:

- Additional resources will become available for domestic programs.
- We will do our share in turning the tide against inflation.

In doing this, we must and we will maintain sufficient strength to ensure our ability to deter aggression and meet our defense needs.

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We have made a determined effort in planning the FY 1971 defense budget to be fiscally responsible, to maintain our current basic capability with modernization as appropriate, and to provide the foundation for our work ahead—that of reshaping our military establishment to support our new strategy and our revised national priorities.

Finally, I must state that this is a rock-bottom budget. I believe that the national security would be jeopardized by any further reductions in our FY 1971 defense budget request. In our testimony throughout the authorization and appropriations processes in the House and Senate, I hope we can convince the Congress that the program presented to you is the right program for the first year of this new decade.

Priorities and Resource Allocation

The Nixon Administration attaches paramount importance to the problem of devising more rational ways for the Federal Government to allocate the resources at its disposal among the many worthy but highly competitive claims. I want to devote this section of my Defense Report to a discussion of what we have done and what we intend to do in support of this task.

Determining the best use of our limited resources is the essence of good planning. During the past year, at the direction of the President, we have mounted a vigorous and determined effort to reduce defense expenditures. We have done so to help combat inflation and to free resources for other pressing needs. The FY 1971 defense budget reflects this continuing effort.

Progress Achieved

The Johnson defense budget for FY 1970 proposed just a year ago was the highest in the last two decades in both requested obligating authority and estimated outlays. In January 1969, defense military and civilian manpower stood at 4,646,082, the highest level since Korea.

Against the perspective of the situation a year ago, two conclusions are obvious as we look at the FY 1971 defense budget and the Federal budget in general.

First, there has been a sharp cutback in the defense budget—a record-setting cut, whose size and impact are not yet fully revealed or comprehended. In mid-March, we plan to announce base closures and related economies required by the reduced budget.

Second, there has been a major realignment of priorities within the Federal budget. Defense reductions have been more than matched by increases in other Federal programs.

Figure 1 highlights some of these changes—starting with the situation a year ago and running through the FY 1971 budget. . . .

Figure 2 [on page 4] shows budget trends over a somewhat longer time span. Let me emphasize a few of the points shown in this table:

- Defense spending in FY 1971

Economic Impact of Defense Programs

	One Year Ago	Today	FY 1971
Total obligating authority	FY 1970 Johnson budget—$85.6 billion	FY 1970 revised—$77 billion	$72.9 billion
Outlays (spending)	FY 1970 Johnson budget—$81.6 billion	FY 1970 revised—$77 billion	$71.8 billion
Defense as a percent of GNP	9.5% FY 1968	8.7% FY 1969	7%
Defense as a percent of Federal budget	40.6% FY 1970 Johnson budget	37.7%, FY 1970 revised	34.6%
Defense manpower military and civilian	4,735,000 June 1970, in Johnson budget	4,364,000 June 1970, in revised budget	4,053,000 June 1971
Personnel entering military service	1,054,000 FY 1970 in Johnson budget	836,000 FY 1970 revised	758,000
Unfilled defense orders in industry	$38.1 billion	$30 billion	
Industry pipeline (unfilled orders related to shipments)	8.6 months	6.8 months	

Defense Outlays in Constant Dollars

($ billions)

	FY 1964	FY 1969	FY 1970	FY 1971
In FY 1964 dollars	$50.8	$65.6	$60.0	$54.6
In FY 1969 dollars	61.3	78.7	72.8	65.9

Figure 1.

will constitute the lowest percentage of total spending by the Federal Government, or of gross national product (GNP), in 20 years.

• From FY 1969 to FY 1971, defense spending has *fallen* by $6.9 billion, while non-defense Federal spending has *risen* by $24.6 billion. This divergence indicates the extent to which defense reductions are now being applied to other national needs.

• From pre-war FY 1964 to FY 1971, defense expenditures show an increase of $21 billion; other Federal expenditures increased by $64.9 billion.

• If the FY 1970 Johnson budget is used as a benchmark, defense spending is *down* $9.8 billion in FY 1971 while other Federal programs are *up* $16.2 billion—a significant shift of priorities in a single year's time.

Defense Budget, Federal Budget, and GNP Selected Years

(Billions of Dollars)

Fiscal Years		GNP	Federal budget outlays: Net total	Dept. of Defense	Other	Off-sets [b]	DOD outlays as percent of: GNP	Federal budget
1950	Lowest year since World War II [a]	$263.3	$43.1	$11.9	$31.2	NA	4.5	27.7
1953	Korea peak [a]	358.9	76.8	47.7	29.1	NA	13.3	62.1
1961	Ten years ago	506.5	97.8	44.6	55.7	−2.5	8.8	44.5
1964	Last prewar year	612.2	118.6	50.8	70.7	−2.9	8.3	41.8
1968	SEA peak [a]	822.6	178.9	78.0	105.5	−4.6	9.5	42.5
1969	Last actual year	900.6	184.6	78.7	111.0	−5.1	8.7	41.5
1970	Johnson budget	960.0	195.3	81.6 [c]	119.4	−5.7	8.5	40.6
1970	Current estimate	960.0	197.9	77.0	127.0	−6.1	8.0	37.7
1971 [e]	Budget estimate	1,020.0	200.8	71.8	135.6	−6.6	7.0	34.6
1971	In 1964 dollars	—	—	54.6	—	—	—	—
Changes:								
	1964 to 1971	+407.8	+82.2	+21.0 [d]	+64.9	−3.7	—	—
	1969 to 1971	+119.4	+16.2	−6.9	+24.6	−1.5	—	—

[a] Measured in terms of defense outlays as a percentage of GNP and Federal budget.
[b] These amounts are undistributed intragrovernmental transactions deducted from Government-wide totals. These include Government contribution for employee retirement and interest received by trust funds.
[c] Includes the $2.6 billion cost of the July 1, 1969, pay raise. The pay-raise costs were not shown in the agency totals, but were included in a Government-wide contingency estimate in the FY 1970 Johnson budget.
[d] 5.2% of the GNP growth during this period, and 24.4% of the increase in the Federal budget.
[e] Lowest percent of GNP since 1951; lowest percent of Federal budget since 1950.

Figure 2.

Looking to the Future

How, then, do we intend to carry forward into FY 1971 and beyond the search for even better and more rational allocation of resources? We must be cautious, for a great deal will depend on events beyond our control. But the general thrust of our program is clear in this transitional budget.

The general context of national concern will be broader than in the past. Our national security will be more carefully related to the strength of our economy and the need for improving the quality of life in America. Because more of our resources will be channeled away from defense, at least on a relative basis, those resources which will be available to support our defense forces will become somewhat scarce, even though we are and will remain the richest nation in the world.

I want to assure this Committee, however, that we shall not be obliged to sacrifice our people's safety. Nothing can have a higher priority than our nation's safety and security. We shall not allow them to be endangered so long as we have the support of Congress and the nation for the continuing essentials of national security. As the President noted in his Foreign Policy Report:

> **Defense spending is of course in a special category. It must never fall short of the minimum needed for security. If it does, the problem of domestic programs may become moot. But neither must we let defense spending grow beyond that justified by the defense of our vital interests while domestic needs go unmet.**

Additional reductions in future years are possible, for one reason because dividends await us from organizational and management improvements. We have not been organized properly in the past. We have not made the most rational and efficient use of those strengths and capabilities

that the defense community has had at its disposal. To rectify this serious shortcoming, the Nixon Administration has put into effect far-reaching organizational improvements and we have instituted some important changes in Defense Department management. Before describing those improvements, let me mention some problems of the governmental environment.

Automatic Regulator

In Government we lack the allocative mechanism provided to business by the marketplace. There are no automatic indicators to tell us how much education to provide, how much welfare, how much defense. In fact, in the American system, we assign to the Government precisely those activities that are not market-oriented. If any activity can be handled on a buyer-seller basis, we generally leave it in the private sector. The public sector normally gets involved only when costs and/or benefits are widely diffused and difficult to measure.

Structural Flaws

In addition to this lack of impersonal benchmarks to guide the allocation of scarce resources, we face structural and institutional difficulties.

The Federal Government has not, in the past, been very well organized across the board to analyze basic problems of resource allocation. We have not had an appropriate mechanism for weighing one Federal program against others within the context of the budget as a whole or in an appropriate time frame.

Let me discuss this complex challenge with the help of the simplified chart shown in Figure 3, which uses defense as an example to illustrate the chain of allocative decisions that must be made.

Of course, the problem is not as simple as this chart suggests, since account must be taken of the feedback that occurs throughout the allocation process. For example, after an overall Federal allocation is established, it may later develop that this allocation is far from optimum, when viewed in the light of actual appropriations enacted, a changed economic environment, or a changed world situation. I think the past experience with Vietnam budgets is a good example. Expenditures were adjusted at all levels, particularly at point 4 within defense, as more resources were devoted to General Purpose Forces. The combination of increases in the Federal budget brought about a major change at point 1—the surtax.

As to the first item on the chart, it is clear we must look at revenues and expenditures together. For example, when we grant exemptions in our tax laws, we are, in effect, spending. In fact, "tax spending" is the current term used to describe this procedure, and it is a huge amount. Would we appropriate these same amounts directly? Clearly, tax spending should meet the same criteria for resource allocation as direct spending, but we have no mechanism for considering them together.

Turning to the second item on the chart, we may note that some activities, such as defense and foreign affairs, are almost completely Federalized. For many others, however, the Federal Government plays only a part —sometimes a relatively small part— in the overall U.S. effort. These include health, education, welfare, housing, and transportation, to name a few. The Federal effort in each of these areas should make sense in terms of the totality of governmental and private activity. And, I must emphasize, all Federal dollars on both sides of the budget are in competition here. Once again, I don't think institutional arrangements are appropriate to our needs.

Moving to the third point, consider what we face in allocating resources within the Federal sector. We find that defense—roughly one-third of the budget total—is completely controlled through the annual authorization-appropriation process. The non-defense portion (two-thirds of the budget) is only about one-quarter so controlled. About 75 percent of the civilian programs are frozen in long-standing statutory formulas and other relatively fixed guidelines. If Congress or the President wants to change the allocation of resources within the Federal sector (or among the Federal and other sectors) in any reasonably short period of time, such as a year or two, the only course open is the appropriation process—but that process covers less than half of the direct-expenditure side of the budget, and none of the tax spending.

Items 4 through 7 refer in the chart, of course, to internal allocational problems of the Defense Department.

What I conclude is that the annual authorization-appropriation process as

Resource Allocation

General to Specific

Sector and Decision Level	Allocative Problem
1. Overall U.S. Economy	Private vs. Public (Government)
2. Government	Federal vs. State vs. Local
3. Federal Government	Defense vs. HEW vs. OEO vs. Transportation, etc.
4. Defense	Strategic vs. Gen. Purpose vs. R&D vs. MAP, etc.
5. Defense Program	ICBMs vs. SLBMs vs. Bombers
6. Defense System	Minuteman vs. Titan vs. Other
7. Defense Weapon	Warhead vs. Guidance vs. Penetration Aids, etc.

Figure 3.

it exists today is not a sufficiently effective means for the timely allocation of resources. It is too limited in scope and in time.

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Needed Improvements

I believe it is clear two things are needed. First, we must get our house in order within the Executive Branch. Then we must approach the Congress with some specific proposals that will facilitate our resource-allocation process.

I want to turn now to the steps we have already initiated in the Executive Branch.

Let me begin by mentioning, briefly, the function of systems analysis, or program review. This is a very important tool within the Defense Department for helping [Deputy Secretary] David Packard and me to make hard choices in acquiring weapons and establishing force goals.

There has been criticism of this function, or of its misuse in the past. Some of this criticism has been justified. In my view, however, systems analysis, when properly used, is an essential management tool.

There are no absolute answers to the kinds of questions we face in Defense Department decision making. Systems analysis, properly used, elevates the level of judgment and helps decision makers to sort out fact and opinion.

Federal Objectives, Resource Allocation

While systematic and rational allocation of resources within and among defense programs makes sense and contributes to efficiency, it will contribute even more if a similar approach were taken at higher levels of decision making. Rational allocation of resources at the topmost levels requires that we define our national objectives. To this end the President has established a National Goals Research Staff in the White House.

National security studies and analyses conducted under the aegis of the National Security Council or unilaterally by the Defense Department, can provide a good deal of information about our world-wide commitments and basic security needs. But in the past, when such analyses were made, they almost never addressed the other parts of the equation, *i.e.*, our non-defense objectives and the resources available to attain them.

Since studies within the National Security Council and the Defense Department focus on requirements, there is a built-in tendency to request more resources than are available. Although our predecessors took steps to mitigate this tendency through the Planning - Programming - Budgeting System within DOD, we cannot and should not expect the Defense Department or the National Security Council to decide on the final allocation of resources between defense and non-defense activities. The President and ultimately the Congress must make these decisions.

Defense Program Review Committee

During this past year, it became increasingly evident that we needed a better way to come to grips with allocation of overall Federal resources to the various Departments—and we needed it quickly. . . .

We have not fully solved the problem of rational resource allocation at the highest levels of Government, but this Administration has taken what I believe to be a pioneering step in integrating national security programs into the overall picture of Federal priorities. Last October, the President established the Defense Program Review Committee (DPRC) to assist him in carrying our his responsibilities for the conduct of national security affairs, particularly in reviewing major defense issues involving military, political, and economic considerations of the highest order. The President discussed the role of this committee in his Foreign Policy Peport.

The DPRC is not just another level of review in the Executive Branch that adds to the burden of our already unwieldy machinery, or that oversees the detailed operation of the Defense Department. This committee is not intended to monitor on-going internal operations, programs, or budget processes of the Defense Department. Nor will it intrude into the process of formulating proposals for defense programs. These functions continue to be the responsibilities of the Secretary of Defense, as heretofore. The Defense Program Review Committee can and does, however, serve a very useful purpose in achieving a proper balance in the resolution of the basic allocative problems in the Federal Government. This committee can and hopefully will:

- Assist the President in determining that our national security commitments and requirements are properly evaluated and costed.
- Review the overall inventory of national resources to provide better insight into balancing the distribution of total Federal resources.
- Help to array for the President the various benefits and costs of higher, and lower, national security budgets. The committee can be particularly useful in explaining, where national security needs seem especially high, the impact of added expenditures on other national goals and the means by which such impact can be ameliorated.

If this group functions effectively in this way, it will further improve our national security decision-making process.

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Strategic Forces

Our strategic forces—both offensive and defensive—account for about 12 percent of the total FY 1971 defense budget, but their vital importance to our security and, indeed, the security of the entire Free World, far transcends their relative cost. These forces unquestionably provide the basic foundation of our deterrent.

Strategic Situation

The President has just reported to Congress and the American people on U.S. foreign policy. Incorporated in his report was a discussion on U.S. strategic policy and the strategic environment. Therefore, in this report, I would like to cover only those factors of specific concern to the Defense Department—the strategic threat, U.S. strategic force planning, and those programs which we propose for FY 1971.

The difficult task before us is to derive a proper balance of forces appropriate to fulfill our objectives in the current and future strategic environment.

Threat

The situation caused by the continuing rapid expansion of Soviet strategic offensive forces is a matter of serious concern. For some time, the Soviet forces which became operational in a given year have often exceeded the previous intelligence projections for that year.

The projections for intercontinental ballistic missile (ICBM) and submarine launched ballistic missile (SLBM) strengths for mid-1970 and mid-1971 have been revised upward in each of the past five years as additional information on Soviet deployments has become available. For example, the current estimates of total operational Soviet ICBM and SLBM launchers expected by mid-1970, when compared with the projections for mid-1970 made last year, show an increase of well over 100 launchers. The same basic trend is evident in the projections for 1971.

The fact that our projections have not reflected all of the growth in Soviet offensive missile strength over the past several years is less important than the actual magnitude of this threat. During the forthcoming year, changes can be expected.

Soviet Strategic Forces

Soviet strategic offensive forces include intercontinental ballistic missiles (ICBMs), ballistic missile submarines, heavy bombers, medium range and intermediate range ballistic missiles (MR/IRBMs), and medium bombers.

Soviet defensive forces, which are the most extensive in the world include interceptor aircraft, surface-to-air missiles (SAMs), and ballistic missile defense (BMD). The interceptor aircraft and SAMs, together with the necessary air warning facilities, are considered air defense forces.

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[A detailed discussion of the strategic threat (Appendix A of the statement to Congress) follows this summary beginning on page 12.]

Strategic Force Planning

Both the Soviet Union and the Chinese Communist strategic nuclear threats, as presently projected through the mid-1970s, have important implications for our own strategic force planning.

Even if the Soviet Union follows a low force-low technology approach during the next few years, it could still have almost 2,000 reentry vehicles in its ICBM force by the mid-1970s. This force, alone, would be more than enough to destroy all U.S. cities of any substantial size. More than half of the U.S. population lies within range of the growing Soviet SLBM force. And, of course, in defense planning, we must also take into account the Soviet bomber force, which is expected to decline only gradually in the near term.

In view of the magnitude of the current Soviet missile threat to the United States, and the prospects of future growth in quantity and quality, we have concluded that a defense of our population against that threat is not now feasible. Thus, we must continue to rely on the retaliatory power of our strategic offensive forces to deter the Soviet leaders from launching a nuclear attack on our cities.

But, if we are to rely on these forces for deterrence, we must be sure that they can at all times and under all foreseeable conditions inflict decisive damage upon the Soviet Union, or any combination of aggressors, even after our forces have been subjected to an all-out nuclear surprise attack. The frequently debated question as to whether or not the Soviets are deliberately seeking to achieve a "first-strike" capability against the United States is an important but not the crucial issue in this context. What *is* crucial is whether they could achieve such a capability in the future. In any event, in evaluating the adequacy of our strategic forces we must always provide for the possibility that the Soviet Union might launch a surprise attack against the United States—particularly if it might assure a more favorable outcome for them. Our strategic forces are primarily designed to deter such an attack. Thus, regardless of how we interpret Soviet intentions, we still must deal with Soviet capabilities in assessing the sufficiency of our strategic forces for deterrence—now and in the future.

Our forces must be adequate to ensure that all potential aggressors are convinced that acts which could lead to nuclear attack or nuclear blackmail

pose unacceptable risks to them.

Our latest analyses of strategic force effectiveness indicate that the presently programmed U.S. forces should be able to provide an adequate deterrent for the near term. For the longer term, there is less certainty that our present capability will remain adequate.

Should the Soviets follow a high-force-high technology approach during the next several years, they could pose not only an overwhelming threat to our cities but also a very formidable threat to our land-based missile forces and bombers.

The rapidly growing Soviet SLBM force does not now constitute a significant threat to our land-based missiles. But, without ABM defense of our bomber bases, by 1972 it could constitute a severe threat to the prelaunch survival of our bomber forces. Under these circumstances, the warning time for our bomber bases located near the coasts could be considerably reduced. With considerably less warning, even our alert bombers could be vulnerable.

According to our best current estimates, we believe that our Polaris and Poseidon submarines at sea can be considered virtually invulnerable today. With a highly concentrated effort, the Soviet Navy today might be able to localize and destroy at sea one or two Polaris submarines. But the massive and expensive undertaking that would be required to extend such a capability using any currently known antisubmarine warfare (ASW) techniques would take time and would certainly be evident.

However, a combination of technological developments and the decisions by the Soviets to undertake a worldwide ASW effort might result in some increased degree of Polaris/Poseidon vulnerability beyond the mid-1970s. I would hope that Polaris would remain invulnerable at least through the 1970s. But, as a defense planner, I would never guarantee the invulnerability of any strategic system beyond the reasonably foreseeable future, say five to seven years.

That is one of the reasons why we are proceeding with the research and development for a new sea-based missile system, the undersea long-range missile system (ULMS). The new, longer-range missile proposed for this system would greatly increase the submarine operating area, thereby making the ASW problem much more difficult from the ocean search and logistic support standpoints. With their long-range missiles, these ships could be based in the United States, and their weapons could be maintained in an "on target" status during the entire deployment period of the submarines.

The foregoing discussion relates to what is frequently called "pre-launch survivability" of U.S. strategic forces, or the number of weapons that would survive an initial Soviet attack and be available for retaliation. We are also concerned about another aspect of survivability, that of ensuring penetration of our weapons through the defenses in the target area.

The Soviet ballistic missile defense system currently deployed around Moscow could destroy some arriving U.S. reentry vehicles. Although this system, by itself, would not significantly degrade a large U.S. retaliatory strike, it must be taken into account in our planning. Moreover, the Soviets are developing new ABM components about which we as yet know little. We will need to watch this program closely (just as we must continue to review the SA-5 SAM system) for possible impact on U.S. retaliatory penetration capabilities.

We are proceeding with a program to place MIRVs on our Minuteman and Poseidon missiles. We consider this program essential to preserve the credibility of U.S. deterrent forces when faced with the growing Soviet strategic threat. The MIRV program will provide a number of small, independently-targetable warheads on a single missile. Should part of our missile force be unexpectedly and severely degraded by Soviet preemptive actions, the increased number of warheads provided by the remaining MIRV missiles will ensure that we have enough warheads to attack the essential soft urban/industrial targets in the Soviet Union. At the same time, the MIRV program gives us increased confidence in our ability to penetrate Soviet ABM defenses, even if, as noted before, part of our missile force were destroyed.

We must consider bomber penetrability as well. Although the combined surveillance, interceptor and SAM programs of the Soviet Union account for a significant and continuing investment of resources, we believe that this network is currently susceptible to penetration by U.S. bombers using appropriate tactics and penetration aids. However, if the Soviets improve their air defenses with a "look-down, shoot-down" intercept system, including both surveillance and intercept aircraft, the penetration capability of our bomber force could be seriously eroded.

To meet the threat of a more sophisticated Soviet air defense, a number of alternatives are available. We are moving forward with the short range attack missile (SRAM) program, and we propose to continue the development of a new subsonic cruise armed decoy (SCAD) for our bomber forces in FY 1971.

The main component of our current bomber force, the B-52, represents early 1950 technology. It has been, and remains today, a useful weapon. We believe that under normal conditions of maintenance and usage, and with certain modifications now programmed, the effective life of some of our B-52s can be extended at least until the late 1970s or early 1980s.

We propose to move forward into engineering development of a new intercontinental jet bomber, the B-1. This aircraft, in comparison with the B-52, is designed to have greatly improved basing survivability, a smaller radar cross section, reduced infrared signature, lower penetration altitudes, higher penetration speed and a greater payload. . . .

* * * * *

Given our interests and obligations in Asia and the Western Pacific, we have two basic alternatives available to us:

- We can rely on our strategic offensive forces for deterrence of Chinese nuclear attack on the United States or its allies. If, nonetheless, we are presented with a Chinese ultimatum to let them have their way in Asia or risk a first-strike nuclear attack on a U.S. city, the President would be confronted with the terrible choice of backing down in Asia, risking the destruction of U.S. cities and loss of American lives, or initiating a

strike against Chinese ICBMs before they are launched.

• We can supplement and sustain the deterrent value of our offensive forces by deployment of a ballistic missile defense system to protect our cities and population against the Chinese Communist ICBM threat.

President Nixon has assured our Asian allies that our nuclear shield extends to them. The credibility of that shield would be greatly enhanced if our Asian allies knew that because of a Safeguard defense the Chinese Communists had virtually no prospect of blackmailing the United States by threatening American cities.

Furthermore, there are several fundamental differences in the problem of deterring Communist China with our strategic offensive forces as compared with the Soviet Union.

While it is true that a large part of their industrial capacity is also concentrated in a relatively few cities, Communist China, in contrast to the Soviet Union, and for that matter the United States, is predominantly a rural society and only a relatively small proportion of the population is urban. This major demographic difference between the United States and the Soviet Union on the one hand, and Communist China on the other, is highlighted in Figure 4.

Some have contended that a relatively small number of warheads detonated over China's 50 largest cities could destroy half of their urban population and more than half of their industry, as well as most of their key government officials and a large majority of their scientific, technical and skilled workers. This amount of destruction, they maintain, should be a sufficient deterrent to an attack by Communist China on the United States.

However, there are other ways the Chinese Communists might use their nuclear capability—as a threat to the United States or our friends in Asia—and while the fact that we can destroy a sizeable proportion of Chinese urban population and industrial capacity is important, it may not necessarily be decisive in this latter case.

China is predominantly a rural society where the great majority of the people live off the land and are dependent only to a limited extent on urban industry for their survival. The key government officials and even the skilled workers can be evacuated from the cities in time of crisis. The Chinese are taking steps to decentralize their industry.

In contrast to China, our population is heavily concentrated in a relatively few large cities—25 percent in the 10 largest U.S. cities compared with 11 percent in the 1,000 largest Chinese cities. Consequently, they could inflict on us a proportionately greater number of fatalities in a small attack than we could inflict on them in a very large attack. Finally, in any nuclear confrontation with Communist China, we would still have to maintain a sufficient deterrent against the Soviet Union. These are problems that we have under review at the present time.

We recognize apparent Chinese ambitions for political hegemony in Asia, and their indicated hostility toward the United States. However, we do not expect them to resort to overt aggression to achieve their political purpose in Asia. Nevertheless, in view of the nature of the developing Chinese nuclear threat, it would seem foolhardy on our part to rely on our deterrent forces only—if a better alternative is available.

A flexible Safeguard defense would serve a future President far better than a rigid offensive capability. As President Nixon said: "No President with the responsibility for the lives and security of the American people could fail to provide this protection." It is crucial that we provide a more complete counter to this potential Chinese threat and, with Safeguard, we have the option to do so.

Safeguard

The evident and continuing threats from the Soviet Union and Communist China force upon us the necessity of continuing progress on the Safeguard anti-ballistic missile defense system in FY 1971. We hope Strategic Arms Limitation Talks (SALT) will lead to a reduced Soviet threat but, meanwhile, it is essential to preserve, as far as possible, all available strategic force options in this transitional budget year. As I indicated earlier, without the Safeguard increment provided by this budget, we would be faced now with the hard decisions about adding immediately to our offensive systems rather than being able to await hoped-for progress in SALT. . . .

The decision of the Administration to request continuation of an orderly, phased Safeguard program for ballistic missile defense—going beyond the Congressionally approved phase I—

Population and Industrial Capacity in 1970
Cumulative Percentage Distribution

(Number of Cities in Order of Population Rank)

No. of Cities	United States Pop.	United States Ind. Cap.	Soviet Union Pop.	Soviet Union Ind. Cap.	Communist China Pop.	Communist China Ind. Cap.
10	25.1	33.1	8.8	25.0	8.7	80–85
50	42.0	55.0	20.0	40.0	6.8	50–60
100	48.0	65.0	25.0	50.0	8.6	65–75
200	55.0	75.0	34.0	62.0	9.0	80–90
400	60.0	82.0	40.0	72.0	10.0	85–90
1000	63.0	86.0	47.0	82.0	11.0	

Figure 4.

was based on:

- Careful consideration of the original objectives of Safeguard defense, and of the need to maintain the President's flexibility on future options to either curtail or expand the system.
- The continued Chinese progress in nuclear weapons.
- The evolving and increasing Soviet offensive weapon threat.
- Our determination to strengthen possibilities for a successful Strategic Arms Limitation agreement.
- The options currently available, considering technical progress and budgetary factors.
- The current international situation.
- Our desire to continue emphasis on strategic *defensive* systems rather than being forced to deploy additional *offensive* weapons or to be forced to move forward now, with making a portion of our Minuteman force mobile.

Objectives and the Decision

President Nixon, on March 14, 1969, announced the following defense objectives for Safeguard:

> **Protection of our land-based retaliatory forces against a direct attack by the Soviet Union.**
>
> **Defense of the American people against the kind of nuclear attack which Communist China is likely to be able to mount within the decade.**
>
> **Protection against the possibility of accidental attacks from any source.**

He further elaborated that:

> **We will provide for local defense of selected Minuteman missile sites and an area defense designed to protect our bomber bases and our command and control authorities.**
>
> **By approving this system, it is possible to reduce U.S. fatalities to a minimum level in the event of a Chinese nuclear attack in the 1970s, or in an accidental attack from any source.**

As the President has indicated, rather than focusing on a single purpose, Safeguard has been and continues to be designed to achieve *several* objectives against a combination of Soviet and Chinese threats.

The President also stated that "this program will be reviewed annually from the point of view of (a) technical developments, (b) the threat, and (c) the diplomatic context including any talks on arms limitation." And, as he reminded the nation in his report on foreign policy, we also promised last year that "each phase of the deployment will be reviewed to ensure that we are doing as much as necessary but not more than that required by the threat existing at that time."

In accordance with this commitment, information was developed on various alternative courses for consideration, and a thorough review has been accomplished by the Defense Department, including the Joint Chiefs of Staff, by the National Security Council, and the Defense Program Review Committee. These reviews led to the President's decision that a further but carefully measured and modified defensive deployment should be requested in FY 1971.

Communist Chinese Threat

Communist China has continued to test nuclear weapons suitable for missiles. Estimates of the date by which they might have an initial ICBM capability vary from 1973 to the mid-1970s. In either case, we must proceed with the area coverage of Safeguard if we are to protect our population from this threat in the late 1970s.

As a further point, however, regarding the Chinese threat, the President made it clear that we are concerned with the very likely prospect of the Chinese gaining an operational capability within the next 10 years. Our past history has shown that where we have avoided important decisions and there is a dramatic revelation of adversary progress affecting our security, the American people and the Congress rightfully have become aroused and have demanded immediate and forceful but expensive responses on a crash basis. Sputnik was a good example.

We know that the Chinese have the capability of testing an ICBM in the immediate future and that they are likely to have an operational capability in the next several years. A measured and orderly deployment of Safeguard, taking only the minimum steps necessary to preserve our ability to meet the threat as it evolves, is both the most prudent and most economical course we can pursue.

Soviet Threat to Minuteman Deterrent

As described earlier, it is apparent that the growth of Soviet forces could present a severe threat to the survival of the Minuteman and bomber forces by the mid-1970s. We are now faced with the following possibilities concerning Minuteman:

- That the Soviets do not increase the deployment of the SS-9 and the SS-11, do not develop a MIRV for the SS-9, and do not improve the ICBM accuracy. Under these circumstances there is no need for a defense of the Minuteman force.
- That the Soviets stop building ICBMs beyond those now operational or started; they do not develop a MIRV for the SS-9; but they do improve the accuracy of their entire ICBM force. Under these circumstances, the force could constitute a threat to the Minuteman force and Safeguard would be quite effective against that threat.
- That the Soviets deploy a MIRV on the SS-9, improve their ICBM accuracy, and do not stop building ICBMs at this time, but continue building them at their present rate. We would then be faced in the mid-1970s with a threat which is much too large to be handled by the level of defense envisioned in the Safeguard system without substantial improvement and modification.

The foregoing factors presented us with a most difficult decision involving three basic choices:

- Should we react to the threats which are possible for the mid-1970s and pay, beginning immediately, the cost of this concern?
- Should we hope that the threat is only modest and stay with the pres-

ent Safeguard deployment?

• Should we assume there will be no serious threat and do nothing?

To be perfectly candid, it must be recognized that the threat could actually turn out to be considerably larger than the Safeguard defense is designed to handle. That is one reason we have decided to pursue several courses which should lead to less expensive options for the solution to this problem than expanding Safeguard to meet the highest threat level. We have further decided to continue deployment of Safeguard because the additional cost needed to defend a portion of Minuteman is small if the full area defense is bought. Safeguard can also serve as a core for growth options in defense of Minuteman, if required.

If, in the future, the defense of Minuteman has to be expanded, new and smaller additional radars placed in Minuteman fields would be less costly than the Safeguard missile site radar because they would not have to cover such large areas. For this reason, we will pursue a program to determine the optimum radar for such a defense and begin the development of this radar and associated components in FY 1971. At the same time, the Air Force will pursue several other options for solving the survivability problem of the land-based missile systems. These will include several concepts involving the Minuteman missile on transporters, in one case a system in which the missile can be moved rapidly into one of many hard shelters —the shelter-based Minuteman. The Air Force will also continue to examine the value of increasing the hardness of the silos in which Minuteman is now based or could be based. These are all research and development programs only, in the FY 1971 budget.

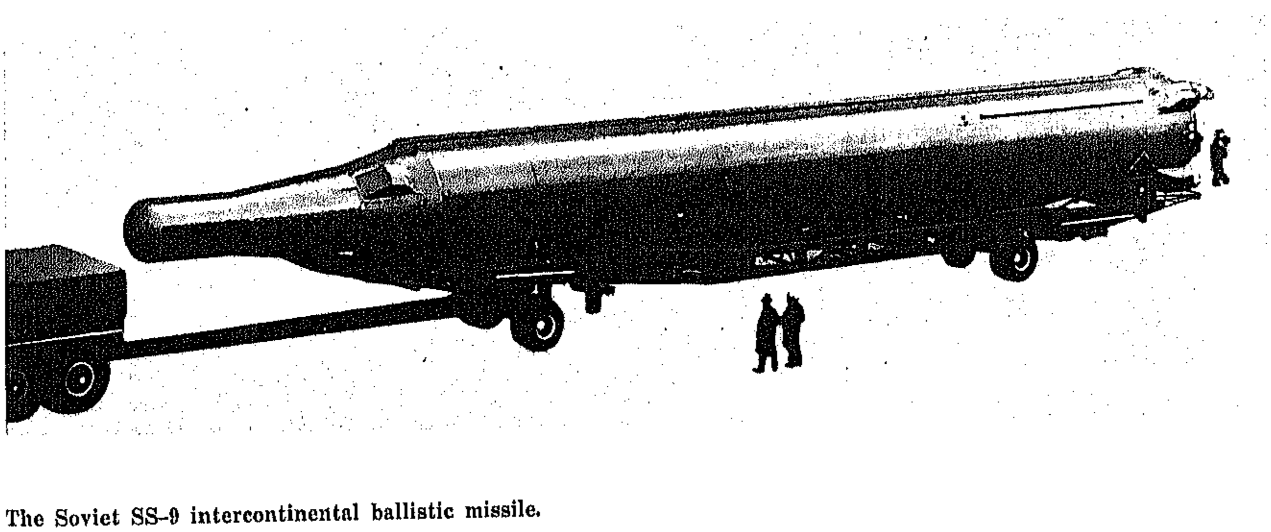
There are, then, several options. The Safeguard defense will serve as a nucleus. We can add a hardpoint defense system if necessary or we may later choose to base part of the force in a different basing concept than the present force. Proceeding with further deployment of Safeguard in FY 1971 postpones the necessity of committing ourselves now either to a mobile Minuteman (on land or afloat) or to further hardening of Minuteman silos. However, should the Soviet threat continue to grow beyond levels that can be reasonably handled by active defense, I can assure this Committee that I will not hesitate at any time to recommend accelerated development of ULMS should the nature of the threat warrant it in the future. . . .

In summary, our decision now to proceed with further deployment of Safeguard gives us another year in which to pursue SALT without ourselves exacerbating the arms control environment through actions on offensive systems. We can do this while still providing a hedge against moderate threats and an option to meet, if necessary, a heavier threat.

Also, production of Soviet nuclear-powered ballistic missile submarines is continuing at two shipyards. By the mid-1970s the Soviets will probably have a submarine force capable of destroying most of our alert bomber and tanker force before it can fly to safety. This same submarine force threatens our National Command Authorities. We need the Safeguard area defense to blunt the first few minutes of such attack so that our bombers can escape and our command system can execute its prime function. Otherwise, we must turn to expensive alternatives such as rebasing or continuous airborne alert.

Strategic Arms Limitations

Naturally, the recommendation we are making for the continued but carefully limited deployment of Safeguard defenses is in full recognition that Strategic Arms Limitation Talks with the Soviets will resume in April for the discussion of many complex issues. Among the factors that have led us to recommend this measured and modified continuation are both the continued growth of the Soviet strategic threat to the United States, and the fact that many possible agreements with the Soviet Union could include some form of missile defense—which would be consistent with our national security objectives and the le-



The Soviet SS-9 intercontinental ballistic missile.

gitimate security interests of the Soviet Union. The decision to begin a modified phase II deployment does not preclude an agreement on low ABM levels.

In addition, it must be borne in mind that the Soviets have no control over the Communist Chinese, whose threat we must therefore cope with regardless of SALT. As President Nixon recently stated: "Ten years from now, the Communist Chinese, among others, may have a significant nuclear capability . . . then it will be very important for the United States to have some kind of defense so that nuclear blackmail could not be used."

An orderly, measured, flexible but ongoing Safeguard defense program will help maintain our relative positive position in SALT and improve the chances for a successful outcome.

An important part of our proposed program is its flexibility. It can be modified as required by changes in the threat which result from arms limitation agreements or unilateral actions by the Soviets or Chinese Communists. In the meantime, it is essential that we continue this defensive program.

Summary

We have made no irrevocable decisions with regard to new strategic force programs. The FY 1971 budget is a transition budget. It is designed to preserve the basic capabilities we currently have while retaining key options until a clearer picture of the future strategic environment emerges. This should come from our own continuing review and from such other factors as SALT and the changing threat.

The strategic offensive forces we plan to maintain in FY 1971 include 552 B-52 and FB-111 bombers, 1,000 Minuteman and 54 Titan II ICBM launchers, and 656 Polaris and Poseidon SLBM launchers; the strategic defensive forces will include about 650 manned interceptors, and about 1,400 surface-to-air missiles on site.

Figure 5 is a summary of selected major strategic programs and associated funding proposed for FY 1971.

Strategic Programs, Proposed Funding

	($ Million)
Initiation of engineering development of Advanced Manned Strategic Aircraft (B-1, AMSA)	100
Initial procurement of Short-Range Attack Missile (SRAM) and continued development of Subsonic Cruise Armed Decoy (SCAD)	297
Continued procurement of Minuteman III missiles and Minuteman force modernization	686
Research and development on Minuteman hardening and rebasing concepts	77
Conversion of six SSBNs to Poseidon configuration	1,017
Advanced development of the Undersea Long-Range Missile System (ULMS)	44
Continuation of engineering development on Airborne Warning and Control System (AWACS)	87
Development and deployment of new satellite strategic surveillance system	219
Continued deployment of Safeguard	1,490

Figure 5.

A more detailed discussion of these and other programs is contained in Appendix B [beginning on page 16].

Appendix A

Size and Character of the Strategic Threat

* * * * *

As noted earlier, during the period when the United States enjoyed a substantial superiority over the Soviet Union, the defense planner had a greater margin of safety within which to design our future posture. Today, when the strategic balance with the Soviet Union is so precarious and Communist China is on her way to becoming a nuclear power, the margin for error in defense planning has virtually disappeared.

Therefore, today more than ever before, we must choose very carefully our future posture based on the best information attainable, for mistakes in the current strategic environment can have far-reaching consequences for the future security of this country.

The Soviet Strategic Threat

Summarized in Figure 6 are the approximate Soviet strategic offensive forces currently estimated operational for Sept. 1, 1968, and Sept. 1, 1969. The programmed U.S. forces for those dates are shown for comparison. This table is similar to those presented in previous annual statements by the Secretary of Defense.

Intercontinental Ballistic Missiles

Last year, in the statement submitted by Secretary Clifford, it was estimated that the Soviets had a total of 900 ICBM launchers operational as of Sept. 1, 1968, compared with 570 in mid-1967 and 250 in mid-1966. This growth has continued, and it is estimated that they had 1,060 operational ICBMs on launchers as of Sept. 1, 1969, an increase of 160 in one year. Almost all of this increase is ac-

counted for by the new SS-9s and SS-11s. The remainder of this increase is accounted for by deployment of the new solid fuel SS-13. The estimated number of older ICBMs (SS-7 and SS-8) for that date is the same as reported for Sept. 1, 1968.

By mid-1970, it is projected that the Soviets will have over 200 more operational ICBMs on launchers. The number of operational SS-9s and SS-11s is expected to increase substantially by mid-1970. In addition, a small increase in numbers of SS-13s is predicted.

It is estimated that the number of operational ICBMs will continue to increase through mid-1971. Beyond mid-1971 the projections become less firm. . . . I would note that if Soviet deployment continues at the average rate of the past several years, the figure of 2,500 launchers that I referred to last spring could be attained by the mid-1970s. However, I am not offering that figure as a forecast, but rather as a possibility which I, as Secretary of Defense, must take into account in planning.

The Soviets are continuing to develop a retrofired weapon which could perform as a depressed trajectory ICBM, a fractional orbit bombardment system, or a dual system. Because of the uncertainties concerning the characteristics and purposes of this weapon system, no deployment estimates are possible. Therefore, they are not considered as separate systems at this time but instead are counted with the SS-9, which is the booster used for these weapons. It is possible that a small number of these weapons are already deployed in SS-9 silos.

Although the increases in numbers of Soviet ICBMs are significant in their own right, the debate on strategic forces last year quite properly highlighted the importance of qualitative factors such as accuracy and payload, and these should also be considered.

At the present time, the accuracy of the SS-9 with a single large warhead is considered sufficient to destroy a Minuteman in its silo, and it is estimated that the accuracy could be further improved.

Development and testing of the three-reentry-vehicle configuration of the SS-9 continues. Whether this is more accurately described as multiple reentry vehicle (MRV) or multiple independent reentry vehicle (MIRV) in the terminology we use, or whether there is any such meaningful distinction in the terminology the Soviets use, is not quite clear at this time. However, it is agreed within our intelligence community that the Soviets are likely to develop MIRVs, as we define them, in the next few years.

We also have indications that modifications are underway on the SS-11. We do not have sufficient information to provide a firm estimate of the objective of these modifications.

As noted earlier, there are no clear indications at this time concerning the longer-term Soviet objectives for their ICBM force, either in quantity or quality. The intelligence community in its most recent projections has identified a range of possible future Soviet ICBM *reentry vehicles* on launchers, based on a series of assumptions with respect to force deployments and technology. No "most likely" case was projected. These deployment estimates range from a "low force-low technology" effort to a "high force-high technology" effort.

If the Soviets follow a low force-low technology approach they could have a few soft target MRVs by mid-1970

U.S. vs. Soviet Intercontinental Strategic Offensive Forces

	1 Sep 1968		1 Sep 1969	
	U.S.	Soviet	U.S.	Soviet
ICBM Launchers [a,b]	1,054	900	1,054	1,060
SLBM Launchers [c]	656	45	656	110
Total Launchers	1,710	945	1,710	1,170
Intercontinental Bombers [d]	646	150	581	140–145
Total Force Loadings [a] Weapons [b]	4,200	1,100	4,200	1,850

[a] U.S. and Soviet ICBM launchers used for training and development are excluded. Only SLBMs on deployable nuclear submarines are included in total force loadings. Total force loadings are for mid-years.

[b] The intelligence community believes the Soviets could have deployed a simple multiple reentry vehicle (MRV) on the SS-9 late in 1969, and that a more advanced MRV system on the SS-9 is possible in late 1970 if the current SS-9 test flights are intended to develop that capability. If the present SS-9 test program is not aimed at a multiple independent reentry vehicle (MIRV) capability, a follow-up system is probable which could provide the Soviets a MIRV capability as early as 1972.

[c] In addition to the SLBMs on nuclear-powered submarines, the Soviets have SLBMs on diesel-powered submarines whose primary targets the intelligence community estimates to be strategic land targets in Eurasia. The Soviets also have submarine-launched cruise missiles whose primarily targets are believed to be naval and merchant vessels.

[d] Only heavy bombers which could fly two-way intercontinental missions are included. In addition, the Soviets have about 50 bombers believed configured as tankers. These could be converted to a bomber role in a relatively short time The Soviets also have a force of over 700 medium bombers and tankers in long-rang aviation capable of striking Eurasian targets.

Figure 6.

and the first hard target MRVs as early as mid-1972. If they followed a high force-high technology approach they would probably skip the MRV and move directly to MIRV, in which case they could have their first MIRVs by mid-1971 and a very formidable hard target kill capability by the mid-1970s. Even with a low force-low technology approach, the hard target kill capability would be considerable.

Submarine-Launched Ballistic Missiles

As already noted, the Soviet Union has surpassed us in numbers of ICBM launchers; we believe that they are now building a ballistic missile submarine force which will be roughly comparable in numbers to our present Polaris fleet. Construction of the new X-class nuclear-powered ballistic missile submarine with 16 tubes continues. We estimate that several of this class were operational as of Sept. 1, 1969, and several more by Feb. 1, 1970. . . .

It is estimated that the total number of Soviet submarine-launched ballistic missile (SLBM) launchers on deployable nuclear submarines increased from 45 on Sept. 1, 1968, to about 110 on Sept. 1, 1969, and further increases are projected through mid-1971. All of this growth is accounted for by the deployment of the Y-class submarines. In early 1969, it was projected that the Soviets could have some 35–50 of these ships, 560–800 SLBM launchers, in 1975–1977. It is now projected that this "end strength" could be achieved in 1974–1975.

One significant development noted this past year has been the testing of a new, probably naval-oriented, ballistic missile. This could possibly be the sawfly missile that was noted in a Soviet parade in 1967, and which at that time was described as a new naval missile.

Manned Bombers

The third element of the Soviet intercontinental strategic offensive forces—Soviet long-range aviation—remains essentially the same as noted in previous years. There is still no evidence that the Soviets intend to deploy a new heavy bomber.

In addition to about 150 Bear and Bison heavy bombers and about 50 Bison tankers currently in inventory, the Soviets also have more than 700 medium bombers and tankers. . . .

Medium Range Ballistic Missiles/ Intermediate Range Ballistic Missiles

No significant changes have occurred in the overall size of the Soviet medium range ballistic missile (MRBM) and intermediate range ballistic missile (IRBM) forces during the last year. Although no specific new IRBM developments have been noted, it appears that research and development on MR/IRBM continues, as does investigation of solid propellants for these missiles.

Manned Interceptors

The Soviet strategic interceptor force now consists of several thousand aircraft, and is continuing the slow downward trend which has been in evidence for some time. Moreover, a large percentage of that force still consists of subsonic or low-supersonic models introduced in 1957 or earlier, *i.e.*, MIG–17s, MIG–19s, and YAK–25s. Most of these older models are day fighters and are armed with guns or rockets. A smaller portion of the force is composed of supersonic, all-weather interceptors introduced in 1959–64, which are armed with air-to-air missiles. A still smaller portion of the force is made up of new aircraft, *i.e.*, YAK–28s, TU–28s and Flagon-As. However, there has been a 5-percent increase in new aircraft during the past year. And, the last two models still appear to be in production, and thus should continue to enter the force.

Beyond the Flagon-A is the Foxbat, a very high performance interceptor. This aircraft may have entered the production stage and the first few could enter the force in 1970.

As the newer model interceptors are introduced into the force, a continuing moderate decline in numbers of interceptors is predicted, although the overall effectiveness of the force should increase.

Surface-to-Air Missiles

Soviet surface-to-air (SAM) systems provide good medium and high altitude defense against subsonic and low-supersonic aircraft and some air-to-surface missiles (ASMs) under all weather conditions. Evidence gained during the past year has reinforced the judgment of the U.S. Intelligence Board that the SA–5 is a long-range SAM system and that it is unlikely to have an anti-ballistic missile (ABM) capability at this time. However, some members of the intelligence community still feel the state of available evidence is such that an ABM role cannot be excluded for the SA–5 system.

Ballistic Missile Defense

During the past year the Soviets appear to have brought a number of the Moscow ABM complexes (ABM–1) to an operational status. Testing of what appears to be an improved Galosh missile has been noted, and such a missile could be available in the near future. No firm estimate of possible capabilities of this improved missile is available. Research and development related to a new ABM system has also continued.

For ballistic missile early warning, and initial tracking, the Soviets rely primarily on large phased array dual radars. . . .

The Chinese Communist Nuclear Threat

Last year, in connection with our consideration of Safeguard, we conducted an extensive review of the available data on the progress of the Chinese Communist ballistic missile programs. A recent National Intelligence Estimate has augmented this review and provided supplementary information on both the ballistic missile and bomber programs.

There are four major activities involved in preparing for deployment of a nuclear weapons force: nuclear ma-

terials production, nuclear weapons development and testing, delivery vehicle development and testing, and construction of delivery vehicle production facilities.

Nuclear Materials Production

The Chinese Communists have been producing U–235 since about 1963. We believe they are also producing plutonium. The actual use of plutonium showed up for the first time in the December 1968 test of a thermonuclear device, CHIC–8.

In their tests of thermonuclear devices the Chinese have also demonstrated the capability to produce both enriched lithium and heavy water. They have an ample supply of natural uranium.

The amount of U–235 now estimated to be available for stockpiling would be sufficient for only a few dozen weapons of any type. Continued production of U–235 will help increase China's stockpile. Nevertheless, a further expansion of fissionable materials production facilities may be required if a large scale nuclear weapons production capability is to be realized. If a second U–235 plant is built, at least three years would be required before production could begin.

Nuclear Weapons Development, Testing

From Oct. 16, 1964, to the end of September 1969, a period of about five years, the Chinese detonated 10 nuclear devices. Six were air-dropped, two were detonated on a tower, one was delivered by a missile, and one was detonated underground. Six of the last eight tests involved thermonuclear devices. The first of these was detonated in May 1966 and produced a yield of more than 200 kilotons (KT). The second was detonated in December 1966 and produced a yield of a few hundred KT. The third was detonated in June 1967 and produced a yield of about 3 megatons (MT). The fourth, detonated in December 1967, was also a thermonuclear device but was a probable failure since it produced only 15–25 KT. The next, detonated on Dec. 27, 1968, produced a yield of about 3 MT. The latest test on Sept. 29, 1969, was also thermonuclear, with an approximate yield of 3 MT.

Thus, with only relatively few shots, the Chinese have made more rapid progress than any other nation. . . .

Four of the last five thermonuclear devices were probably air-dropped by a medium range bomber. With only their fourth test the Chinese delivered by missile a fission device yielding about 10 KT. Should the Chinese decide to deploy an MRBM in the immediate future they would have to rely on fission warheads for this purpose.

Delivery Vehicle Development, Testing

The Chinese Communists have been working on an MRBM for a number of years. By 1965, activity at the principal missile test range had become very noticeable. And, as noted earlier, they actually delivered a nuclear device with a missile in the October 1966 test. By the summer of 1967, the rate of test firings greatly exceeded the level considered normal for a research and development program, leading the intelligence community to believe that deployment might be imminent. Yet, two and one-half years later, we still have no hard evidence that an MRBM is actually being deployed, although we continue to note indications that they are moving toward such a deployment.

The MRBM program may have been delayed by technical problems with the missile itself. Or, it may have been disrupted by the Cultural Revolution. There is even the possibility that the Chinese never intend to deploy their first generation MRBM, choosing to wait for a more advanced missile and warhead. In any event, we believe that it is possible for the Chinese to have a force of 80–100 operational MRBMs by the mid-1970s. Although this system does not pose a direct threat to the United States, it would threaten certain U.S. bases and allies in the Far East.

Given the experience already acquired with the MRBM, however, there is no reason to believe that the Chinese cannot in time develop and deploy an ICBM. We know that a large ballistic missile launch facility already exists. In fact, it was the construction of this facility, which probably began in 1965, that led the intelligence community in late 1966 to estimate that the Chinese Communists could launch their first ICBM (or space shot) before the end of 1967. While there is as yet no convincing evidence that they have begun flight testing from that facility, we still believe that they will attempt to test launch their first ICBM or space booster in the near future.

Should an ICBM become available for testing within the next few months, initial operating capability (IOC) could be achieved by early 1973. It is more likely, however, that IOC will be later, perhaps by as much as two or three years. If the earliest possible IOC were achieved, the number of operational launchers might fall somewhere between 10 and 25 in 1975. . . .

Delivery Vehicle Production Facilities

We have known since 1963 that the Chinese Communists were constructing a large ballistic missile production facility. Whether ICBMs are now being produced there is still not known, but some MRBMs probably are.

The Chinese are estimated to have a limited number of TU–16 Badger aircraft currently in inventory. We believe that the TU–16 would probably be the principal nuclear delivery system for the near future.

Although the Chinese have one Soviet-type G-class diesel-powered missile launching submarine which they continue to work on, we have no evidence that they have developed a missile for it. Moreover, diesel-powered submarines with their limited endurance and high noise levels do not pose a large threat against the continental United States.

In summary, it appears that the Chinese Communists are proceeding with their medium-range bomber program to provide a limited nuclear delivery capability at an early date in the Asian area, out to about 1,600 nautical miles, and concurrently are proceeding with MRBM and ICBM development. But, the intelligence community believes that the Chinese face some hard choices in the near future regarding the overall direction of

their nuclear weapons program, the associated delivery vehicles, and the consequent impact on their general purpose forces. In addition to the problems of military versus domestic resource allocation, and allocation within the military forces, the current Sino-Soviet dispute is also likely to have an affect on their decisions. What these decisions will be we cannot now forecast.

In any event, the Chinese Communists seem to have all of the major elements required for the production and deployment of ICBMs. After examining the available data, we have concluded that the potential threat is very real, and that they will ultimately deploy a force of ICBMs. What is still uncertain is when they will start deployment and how large and how good a force they will have by the mid-1970s and beyond.

Appendix B

U.S. Strategic Force Programs for FY 1971

The specific Strategic Forces programs we are recommending for FY 1971 are:

Strategic Offensive Forces

Strategic Bomber Forces

The manned bomber forces proposed for FY 1971 reflect a number of changes since submission of the original FY 1970 budget a year ago.

In the amendments to the FY 1970 budget we decided to cut off the FB-111 program at four squadrons, rather than buying six squadrons as planned in the original budget. The FY 1969 procurement of this aircraft was reduced from 70 to 42, and the FY 1970 buy was eliminated. The FB-111 has a relatively small payload, and we believe the B-1 is a more appropriate solution for a longer-term bomber program.

. . . Our *tentative* program now calls for all four [FB-111] squadrons to be operational by the end of FY 1971. . . . However, it should be emphasized that the entire F-111 program is being reexamined as a result of the more recent structural problems encountered with the fighter version. . . .

All of the B-58s are being phased out in FY 1970. Eliminating these aircraft and their logistic support structure, and retaining additional B-52 C/Fs instead, permits savings in operating costs.

A year ago the Air Force planned to maintain eight squadrons (132 authorized active inventory aircraft) of B-52 C/F aircraft. . . . This past year, to offset the phase-out of the B-58s, as well as the reduction in the planned FB-111 force, we decided to retain three additional squadrons of B-52 C/Fs through FY 1970. . . .

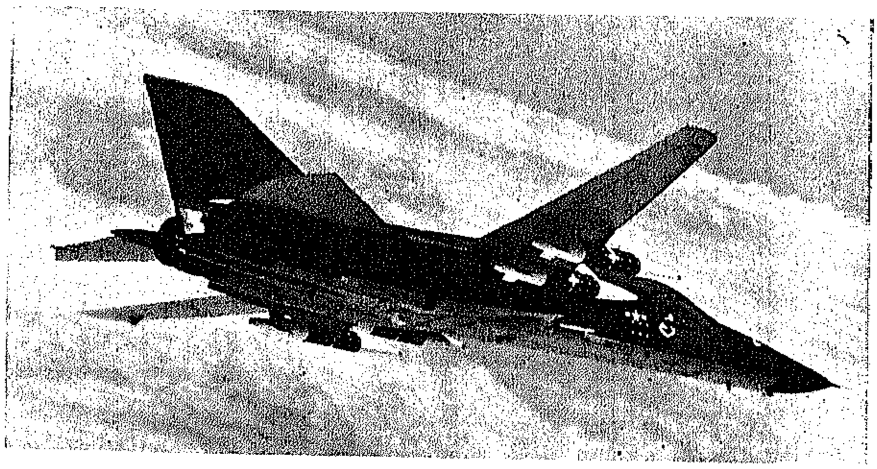
In FY 1971 we plan to eliminate one squadron stationed in Southeast Asia and one Continental U.S. (CONUS)-based squadron. This will leave a total of 12 B-52 C/F squadrons, 10 based in CONUS (including two Southeast Asia rotational squadrons) and two stationed in Southeast Asia. . . .

The existing force of B-52 G/Hs, together with their Hound Dog air-launched missiles, will be maintained through FY 1971.

To enhance the pre-launch survivability of our strategic bombers against the potential Soviet SLBM threat, alert aircraft are being dispersed over a greater number of bases. Some satellite bases will be added to the 28 existing main bases. Each satellite base will have the minimum facilities needed to support alert aircraft, including both tankers and bombers. Several satellite bases are scheduled to be in operation by end FY 1970, and all of them by end FY 1972.

Another important part of the bomber force program involves measures to increase bomber penetration capability. The major current effort in this area is the short range attack missile (SRAM) now in the final stages of development. SRAM is an air-to-surface missile designed to be carried on the B-52 G/H, FB-111 and B-1, for use against terminal defenses.

The program proposed by the outgoing Administration a year ago would have initiated procurement of operational missiles and SRAM modifications on B-52s and FB-111s in late FY 1969. Because the program was still experiencing developmental difficulties, principally in connection with the missile's solid rocket motor, we decided in our initial review of the FY 1970 budget to defer missile procurement and aircraft modification. The bulk of the funds available in FY 1969 and requested in FY 1970 for these purposes were deleted, but some additional funds were provided for research, development, test and evaluation (RDT&E) to help absorb some of the overhead costs which otherwise would have been charged to procurement. Furthermore, the production options in the existing fixed-price incen-



Short range attack missile (SRAM) now in final stages of development.

tive contract were permitted to lapse last year, limiting the current contract to development only.

We plan to pursue SRAM development through testing before a commitment to production is made. If the test results are satisfactory, a new production contract will be awarded and the fabrication of production tooling would be started with the $10 million provided in FY 1970 for that purpose. The FY 1971 request includes $46 million for RDT&E which, together with the additional $9.7 million we propose to reprogram for this purpose in FY 1970, will fund all but $6 million of the total estimated SRAM development cost ($434 million). Also included in the FY 1971 budget is $110 million for missile procurement (including missiles, spares and other items) and $107 million for aircraft modifications ($93 million for B-52s and $14 million for FB-111s).

Work on the subsonic cruise armed decoy (SCAD), an advanced bomber penetration aid which is intended to counter the Soviet area defenses, will also be continued in FY 1971. The characteristics of SCAD will be more precisely defined in the next several months. It is planned to proceed with the development of actual hardware in FY 1971, and $33.6 million has been included in the budget for that purpose. We may ask two contractors to develop prototype flight vehicles before deciding which one to procure for the operational inventory.

Missile Forces

The planned missile force program for FY 1971 is similar to that presented last year—1,000 Minuteman, 54 Titan IIs, and 656 SLBMs. The major changes from last year concern the Minuteman III deployment rate and the Poseidon conversion program.

Minuteman. Last April, in the amendments to the FY 1970 budget, the Minuteman III deployment rate was reduced. We plan to maintain this lower rate of deployment through the FY 1971 funding period which will cause some delay in the planned completion of the force modernization. As noted in last April's testimony, more Minuteman Is will be retained in the force to compensate for the slower deployment of Minuteman III.

The initial procurement of Minuteman III missiles was made in FY 1969, and additional missiles are being bought in FY 1970. We have reduced the planned Minuteman III FY 1970 procurement by deferring 16 test and spare missiles to a later year. A total of about $686 million is requested in FY 1971 for the Minuteman procurement program, including about $475 million for the procurement of additional Minuteman IIIs in order to support the planned deployment rate and to provide for operational testing.

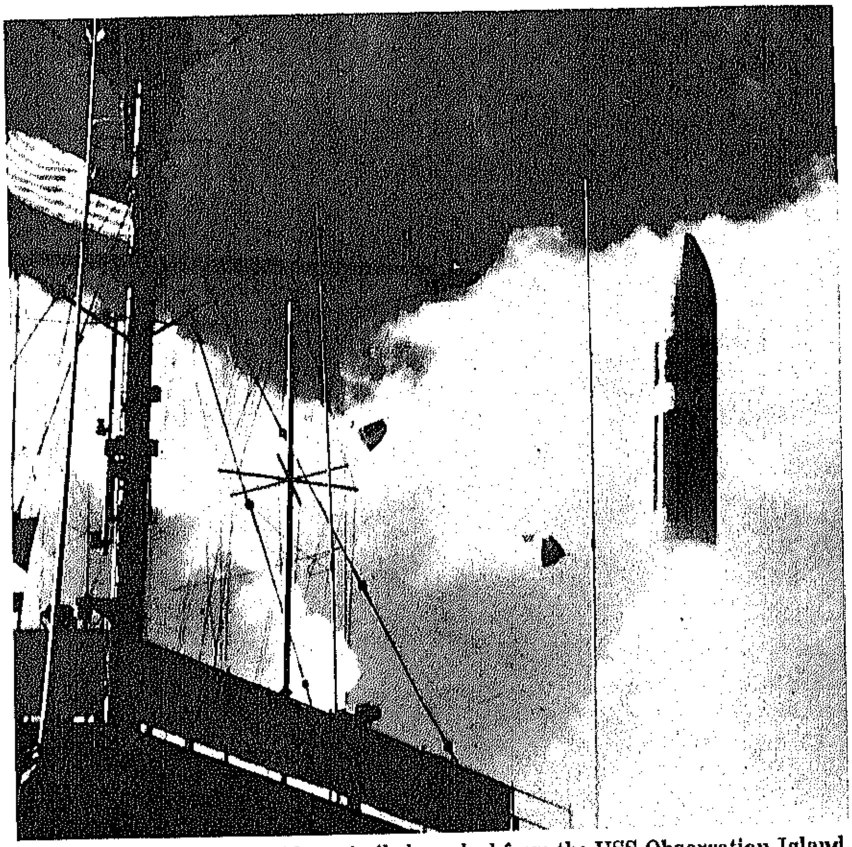
We also plan to continue our effort to provide additional protection for all Minuteman IIs against nuclear radiation effects while in flight. Some of the Minuteman IIs should be hardened to withstand these effects by late 1970. The total cost of hardening the rest is estimated to be about $107 million. About $8 million was provided in FY 1970, about $40 million is requested for FY 1971, and the balance will have to be financed in future years.

Two aspects of the Minuteman operational testing program are worthy of note. . . . The Air Force plans to conduct the first tests in FY 1971 and additional tests in future years. In addition, we now propose to actually launch one or more missiles (without warheads) from operational silos to demonstrate combat readiness and acquire a full systems evaluation of a complete firing. A total of about $31 million has been included in the FY 1971 budget for this purpose, mostly for research and development on special equipment needed for safety and for directing and monitoring the launches.

Several concepts to reduce Minuteman basing vulnerability are currently being investigated. A total of $77 million is included in the FY 1971 budget to initiate development work on the most promising concepts that emerge from this investigation.

Titan II. There will be 54 of the large warhead Titan IIs in the forces at the end of FY 1970 and 1971, the same program as proposed last year.

Polaris/Poseidon. Although we still plan to convert a total of 31 nuclear-



The U.S. Navy's 16th Poseidon missile launched from the USS Observation Island, a sea-going experimental launch base.

powered submarines (SSBNs) from the Polaris to the Poseidon configuration, the changes made by the Congress last year have necessitated another rescheduling. Two conversions were authorized for FY 1968 and two more for FY 1969. For FY 1970, we requested six, but the Congress provided funds for only four.

The Poseidon test program through January 1970 has achieved 11 successes in 15 firings, and is well ahead of the Polaris program at a similar stage of development. . . .

The test data on the Poseidon program has been carefully reviewed. It appears that Poseidon will meet and perhaps exceed its development test objectives. . . . Accordingly, we propose to start six more conversions in FY 1971, leaving 17 to be funded in later years. . . .

The Poseidon conversions are planned to be performed at the time of a normal overhaul. . . . All eight SSBNs thus far authorized for conversion are now in the shipyards. The first Poseidon equipped SSBN is scheduled to be deployed in January 1971.

New Strategic Offensive Systems

Contractor proposals on the new B-1 intercontinental bomber are now being evaluated by the Air Force. Source selection is scheduled for May 1970, at which time it is planned that contracts will be awarded for engine and system development. However, no production decision need be made at that time.

Because the FY 1970 appropriations were enacted so late in the year, and because of other delays in the program, we expect to use only about $40 million of the approximately $100 million made available for that year. In addition, $4 million is available from FY 1969 funds. Thus, we already have $64 million which can be applied to the FY 1971 development program. These funds, together with the $100 million requested in the FY 1971 budget, will be sufficient to permit engineering development to proceed on an orderly basis.

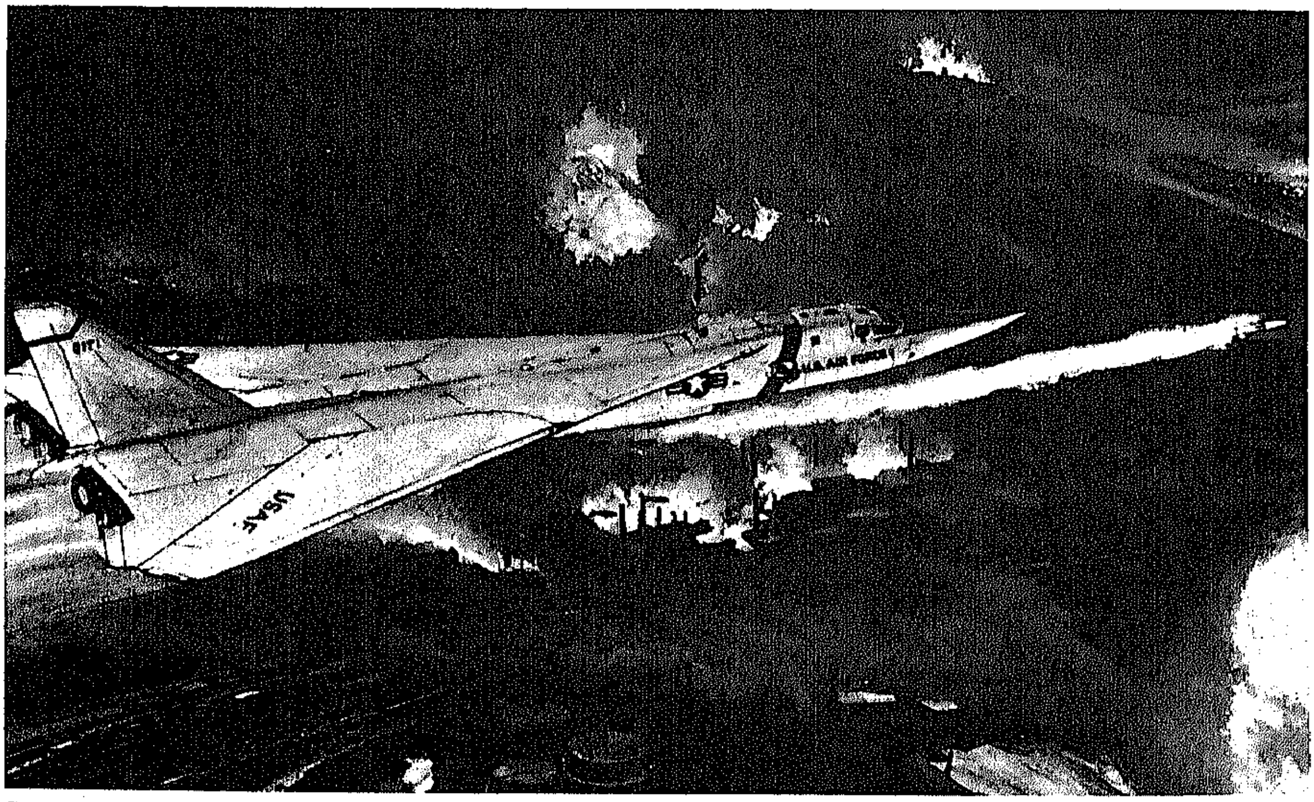
We are also requesting $44 million in the FY 1971 budget to proceed with detailed design studies for the new undersea long range missile system (ULMS). Last year $20 million was originally requested for this project, but the Congress provided only $10 million for preliminary submarine hull design, and studies of the new missile and other portions of the system related to submarine design. The funds requested for FY 1971 will be used primarily for the detailed designs of the submarine and those portions of the weapon system affecting submarine design.

We have also included $6 million in the FY 1971 budget to continue work on technology applicable to advanced ICBM systems.

Strategic Defensive Forces

Bomber Defense

The current bomber defense system, as the Congress is aware, has a limited combat effectiveness and is expensive to operate. Accordingly, while research and development on a modernized system progresses, we plan to



Contractor proposals on the new B-1 intercontinental bomber are now being evaluated.

continue in FY 1971 the phasedown of the existing system in such a way as to make the best use of the remaining forces.

Surveillance, Warning and Control. Extensive revisions are now being made in the surveillance, warning and control systems, including the organization of the command structure. What we are trying to do is to retain a system which, although reduced somewhat from the program planned last year, still provides coverage of the most important threat corridors.

Under the revised plan, the Continental United States and part of Canada have been divided into six Air Defense regions, each of which has one region control center backed up by two BUIC III control centers. In addition, there is one air defense region almost completely in Canada and one in Alaska. The Canadian region also has a region control center, backed up by two BUIC III control centers, plus a manual control center in Labrador. The Alaskan region has a manual region control center. All SAGE region control centers are tied directly into the North American Air Defense Command (NORAD) Combat Operation Center and will manage the air battle in the region (a function formerly performed by the combat centers) as well as conduct the actual intercepts. The Alaskan region control center is also tied directly into NORAD, and is responsible for battle management with the subordinate manual control centers conducting the intercepts.

As a part of the FY 1970 expenditure reduction effort, the number of search radars was reduced from 118 to 112. . . . No further reduction is planned in the number of DEW Line radars beyond the reduction in FY 1970 from 39 to 33. . . .

Last year, in the FY 1970 budget adjustments, we had planned to reduce the EC-121 airborne early warning force, which is quite costly to operate. We subsequently decided to retain three additional EC-121 aircraft in Florida, in order to provide airborne radar coverage over the approaches from Cuba. Interceptor aircraft (drawn from Air Force or Navy resources) are maintained on alert in Florida under NORAD operational control to provide an interceptor capability in the area.

Manned Interceptors. During FY 1970, in addition to the reductions proposed by Secretary Clifford last January, the Alaskan F-102s and the remaining F-104 squadron in the active forces were phased out, and three F-101 squadrons were transferred to the Air National Guard. This leaves for defense of the Continental United States three F-101 squadrons and 11 F-106 squadrons in the active forces, augmented by 3 F-101 and 13 F-102 squadrons in the Air National Guard. In addition, 1 F-102 squadron is stationed in Hawaii for air defense of that area. The last 2 squadrons of F-89s have been phased out of the Air National Guard.

Surface-to-Air Missiles. Although some inactivations of Nike-Hercules batteries were planned in last year's initial budget request, this phasedown was accelerated by the FY 1970 expenditure reduction effort. . . .

Twelve of the Army National Guard Nike-Hercules batteries will be inactivated during FY 1970, three more than contemplated last November. . . .

Finally, one Bomarc squadron was phased out in FY 1970, leaving a total of five in the forces with the remaining assets distributed among the other squadrons.

Air Defense Modernization. The three major components of the air defense modernization program are the airborne warning and control system (AWACS), the over-the-horizon (OTH) radar, and an improved interceptor. Additional research and development funding for each is requested for FY 1971.

Perhaps the most important of the three is AWACS, an airborne surveillance, command, control and communication system consisting of special avionics and a large radar installed in a military version of a commercial jet aircraft such as the DC-8 or 707. The main feature of the AWACS would be the radar's ability to see low-flying aircraft against the surface clutter over land or sea. The technical feasibility of the principal components of such a radar has already been demonstrated in the Overland Radar Technology program. But the only way we can determine how well it will work in actual practice is to develop a full-scale radar, install it in an aircraft together with the other critical components, and test the entire system in an operational environment.

Accordingly, the development program now proposed is keyed to the actual demonstration of a working radar. Engineering development is scheduled to commence in early 1970. The first two and one-half years would be devoted primarily to the competitive development of two different full-scale prototype radars, which would be flight tested sometime in early FY 1972, in the actual aircraft selected for this mission. This would enable us to choose the better of the two radars if we decide to go ahead with AWACS procurement. We see no need for more than one prime systems contractor, however, and this selection will be made in March 1970. The approach we have adopted for this program would limit our initial commitment simply to the flight test of the radars. No decision on procurement need be made until the radar performance is successfully demonstrated, and we do not intend to make any further commitments until that program milestone has been reached. A total of $87 million has been included in the FY 1971 budget to continue engineering development of the system.

The second major component is the CONUS over-the-horizon (OTH) radar, which would provide a distant, all altitude detection line against aircraft approaching the United States from the sea. The purpose of this radar is to provide a long-range bomber detection line, which would alert the AWACS in time to enable it to reach its combat station from ground alert, thus avoiding costly airborne patrols in peacetime.

A total of $3 million has been provided for the CONUS OTH radar in FY 1970 and contract definition is scheduled to be initiated in the near future. An additional $5.3 million is requested for FY 1971, $3.3 million to complete contract definition and $2 million to conduct experiments.

The third major component is an improved interceptor. Inasmuch as the Congress has failed to approve the Defense Department's earlier plan to modernize the F-106 force with a new "look-down, shoot-down" fire control

and missile system, we are now examining other aircraft for this role, including the F-14 and an interceptor version of the F-15. A total of $2.5 million was provided in FY 1970, and $2.5 million is requested in FY 1971 to continue studies. . . .

Anti-Satellite Defense and Space and Missile Warning

No changes are planned in the present active anti-satellite defense capability.

Satellite tracking and identification will continue to be provided in FY 1971 by the existing SPADATS system, which is made up of the Navy's SPASUR system and the USAF's SPACETRACK system. . . .

Early warning of ballistic missile attack is currently provided by: (1) the ballistic missile early warning system (BMEWS), consisting of three radar sites guarding the northern approaches, and (2) the "forward-scatter" over-the-horizon radar system. . . .

During FY 1970, a system designed specifically for warning of submarine-launched ballistic missile (SLBM) launches will become operational. This system (474N) consists of seven mechanical scan radars, three on each coast and one in Texas, which provide warning upon launch of enemy SLBMs.

We are also currently developing a new, much more advanced satellite strategic surveillance system which promises a good early warning capability against SLBMs and FOBS (fractional orbit bombardment system), as well as ICBMs. A total of $219 million has been included in the FY 1971 budget for this system.

Civil Defense

A complete review of the Civil Defense Program is now being conducted by the Office of Emergency Preparedness at the direction of the National Security Council. Pending completion of that study, now expected in March, no major changes are proposed in the Civil Defense Program.

. . . We plan to continue in FY 1971 a limited effort to increase the number of identified shelter spaces, particularly in "deficit" areas where they are most needed. . . .

A total of $73.8 million is being requested for Civil Defense in FY 1971. . . .

The situation in South Vietnam is one significant current factor in our General Purpose Forces planning.

General Purpose Forces

The Nixon Doctrine, which was discussed earlier, has a significant impact on our General Purposes Forces. We rely on these forces for all military actions short of strategic nuclear war. Included in this category are most of the Army combat and combat support forces, all of the Marine Corps forces, virtually all of the Navy forces (except ballistic missile submarines), and the tactical units of the Air Force.

As the members of this Committee are well aware, our requirements for General Purpose Forces are based largely on the need to be prepared to help defend the territories of other nations with whom we have mutual defense agreements approved by the Congress, or whose defense is vital to our own national security interests.

We have bilateral or multilateral collective defense treaties with more than 40 countries around the world. These treaties, however, do not define the precise manner in which we are required to fulfill our military obligations. Consequently, these obligations cannot be unalterably translated into clearly defined and measurable force requirements. That is why it is not possible to provide a precise analysis of what our obligations represent in terms of U.S. military forces.

It is quite apparent, however, that our obligations overseas do in fact pose a definite, though imprecise requirement for U.S. General Purpose Forces. The size and character of the forces that should be maintained depend to a large extent on how we plan to meet these obligations under various sets of circumstances and how we assess the extent, size, character, and urgency of the threats to the nations involved as well as the varying capabilities of those threatened nations to defend themselves.

Much has been made of the issue of United States commitments in recent times, and the forces which might be appropriate to fulfill these obligations. Actually, the issue is deeper, as President Nixon has just told us:

> **It is misleading, moreover, to pose the fundamental question so largely in terms of commitments. Our objective, in the first instance, is to support our interests over the long run with a sound foreign policy. The more that policy is based on a realistic assessment of our and others' interests, the more effective our role in the world can be. We are not involved in the world because we have commitments; we have commitments because we are involved. Our interests must shape our commitments, rather than the other way around.**

The President also noted that:

> **The United States, like any other nation, has interests of its own, and will defend those interests. But any nation today must define its interests with special concern for the interests of others.**

We have and must maintain a considerable degree of flexibility in how we choose to be prepared to meet our military obligations under any particular set of circumstances. As you know, the previous Administration chose to design our General Purpose Forces, in the words of Secretary Clifford, ". . . to meet simultaneously two major contingencies (one in Europe and one in Asia) and one minor contingency, as well as a 'War at Sea.'" This policy is popularly known as the "2½ war strategy," although such a description greatly oversimplifies the complexities of General Purpose Force planning.

The review of basic U.S. security policy conducted this past year through the National Security Council process has provided an evaluation of our present capabilities and highlighted many of the factors that must be considered in determining our future General Purpose Forces strategy. On the basis of this review, the President has reaffirmed U.S. support for the agreed NATO strategy and maintenance of substantial forces in Europe. The primary U.S. objective in Asia will be to help our allies develop the capability to defend themselves, while continuing to honor our obligations.

As the President has described it in his report on foreign policy, under our new strategy we will maintain in peacetime General Purpose Forces that are adequate for simultaneously meeting a major Communist attack in either Europe or in Asia, assisting allies to cope with non-Chinese threats in Asia, and in addition, meeting a contingency elsewhere.

We intend to maintain the required ground, tactical air, and naval forces to support this strategy. Some of these forces will be deployed, and others, both active and reserve, will be based in the United States.

In Europe, we plan to maintain the U.S. combat forces currently deployed through FY 1971. These forces, reinforced from the United States, together with those of our NATO allies, should be capable of meeting a major Communist attack in Europe and should also be capable of coping with small or slowly developing crises and attacks.

In Asia, we seek to help our allies develop the capability to defend themselves with the United States providing materiel and logistic support. However, most of these countries lack adequate air and seapower. Considerable time and resources will be required to solve this problem.

As President Nixon noted, our approach to the decade of the 1970s in Asia requires a commitment by the United States to help our partners develop their own strength. He further noted that:

> **. . . we must strike a careful balance. If we do too little to help**

them—and erode their belief in our commitments—they may lose the necessary will to conduct their own self-defense or become disheartened about prospects of development. Yet, if we do too much, and American forces do what local forces can and should be doing, we promote dependence rather than independence.

Thus, we must maintain flexibility with regard to the United States' role in partnership for defense in Asia. There are many uncertainties ahead, and we should be under no illusion that easy answers are available for the complex issues which face us in Asia.

Europe and the NATO Area

The need for an adequate NATO force remains most important as we attempt to move toward an era of negotiations. We intend to continue doing our fair share for the defense of Europe. We have told our allies that we intend to maintain our present combat troop levels in Europe in FY 1971, and our budget has been prepared on this basis.

There has been some improvement in the quality of NATO forces within the last year, but more remains to be done if NATO forces are to have the necessary degree of combat effectiveness and readiness. We will continue to encourage our NATO allies to improve their forces and assume more of the total NATO defense burden.

The President has treated the situation in Europe in some detail in his review of foreign policy. Included in an Appendix is a discussion of the Warsaw Pact Threat. Here, however, I would like to note one more point. As Secretary of Defense, I am concerned about the growing Soviet presence in the Mediterranean Basin.

Soviet influence and presence in this region have increased, and ties with the Arab countries on the eastern and southern edges of the Mediterranean have contributed to this change. Soviet military and economic assistance to Arab countries, for example, has totaled more than $5 billion from 1966 through 1968.

From the strategic point of view, hostile control of the Mediterranean would constitute a grave threat to the security of Europe as well as the U.S. interests in the Near East and North Africa.

Asia, the Pacific and Vietnam

In the Pacific area, we are all familiar with the threat posed by the North Vietnamese. North Korea is also a militarily strong and unpredictable country, with some 350,000 troops and an effective air force of more than 500 aircraft (including MIG-21s). Lying behind these forces is Communist China which has a massive army of close to 2½ million troops and an air force of over 2,900 jet fighters. The Chinese, however, seem to be careful to avoid direct combat involvement of their own personnel in military operations associated with the so-called "liberation movements." Moreover, their current difficulties with the Soviet Union may serve as a restraint to any major military operations outside their own borders. Nevertheless, Chinese Communist ambitions for great power status and regional hegemony are recognized by the nations of Asia as well as ourselves, and China's geographical position and potential for realizing its ambitions pose a pervading psychological and actual threat to the peace and security of the Asian area.

The principal threat to the independent nations in Asia is internal insurgency, supported by external assistance. This is an important aspect of the threat to which our General Purpose Force planning for Asia should be oriented. The situation in Vietnam is obviously the most significant current factor influencing this planning.

Last November, I discussed the situation in Vietnam and our progress in Vietnamization before the Senate Foreign Relations Committee. Since then, President Nixon has announced the third reduction of U.S. forces in South Vietnam, bringing the total authorized strength down from 549,500 established by the preceding Administration to a new total of 434,000 to be attained by April 15, 1970. This represents a reduction in authorized strength of 115,500 troops, or just about 21 percent, in a period of 10 months.

Vietnamization offers the prospect of a situation in which the South Vietnamese can manage without the support of U.S. combat operations, and the prospect, one day, of peace with freedom from external domination.

The policy of this Administration is to continue to reduce the number of U.S. military personnel in South Vietnam based on the criteria set forth by the President:

- Progress in Vietnamization.
- The level of enemy activity.
- Progress toward a negotiated peace in Paris.

Although I believe continued progress in our Vietnamization program will permit further reductions in American forces after April 15, 1970, I will not at this time project U.S. deployments there beyond that date in order to preserve the flexibility which the President requires for his program for peace.

Studies are currently underway to develop force, equipping and support requirements covering accelerated Vietnamization. Specific requirements to support the most effective program for transfer of combat responsibility to the forces of South Vietnam will be under continuing development and review. As such requirements are finalized, they will require funding. In order to provide the funds the Defense Department needs to support this vital program, I have included $300 million in a special appropriation, "Combat Readiness, South Vietnamese Forces." These funds will be available for transfer, upon Presidential determination that such action is necessary, to any appropriation available to the Defense Department. Upon transfer, they would be merged with the appropriations to which transferred and remain available until expended.

In addition, $150 million will be derived by transfer from any appropriations available to DOD for obligation in the current fiscal year. . . .

Military Assistance and Sales

Attainment of the President's goals with respect both to national security policy and the solution of domestic problems requires a judicious and balanced allocation of resources. I discussed earlier the basic problem of resource allocation. An important element of national security policy—and one that will be more important in the future under our new policy—is the Military Assistance Program (MAP).

As President Nixon noted in his State of the Union Address:

> **Peace requires partnership, or we will forever exhaust our resources in a vain and unproductive effort to dominate our friends and forever isolate our enemies.**

The policy of peace through partnership and strength, which marks our new approach to defense planning, must be buttressed by an improved program of military assistance, training, and sales. This is essential to provide our allies with the resources and skills they will need as they assume greatly increased responsibilities for their own defense. I cannot stress too strongly the need for increased understanding of the importance of this program to the success of the Nixon Doctrine.

That is why we believe that military assistance should be integrated into the DOD budget so that we can plan more rationally and present to the Congress more fully an integrated program for peace through partnership and strength.

* * * * *

The challenging objectives we face under the new policy can be achieved only if we and our allies both contribute to them. Each nation must do its share and contribute what it can appropriately provide—manpower from many of our allies; technology, material, and specialized skills from the United States. In many cases, our allies are able and willing to provide the forces if we can contribute some of the needed weapons, and, in some circumstances, specialized military support. Under this approach, each partner would be doing what it can best do and both would benefit.

The Military Assistance Program is the key to this approach. It is the essential ingredient of our policy if we are to honor our obligations, support our allies, and yet reduce the likelihood of having to commit American ground combat units. When looked at in these terms, a MAP dollar is of far greater value than a dollar spent directly on U.S. forces.

In recent years, however, lack of popular support, general concern about U.S. involvement overseas and valid domestic priorities have led to a decline in appropriations. This decline has made it increasingly difficult to enlist the full potential contribution of grant assistance and credit-financed Foreign Military Sales (FMS) toward attainment of the security objectives of the United States.

The President's redefinition of those objectives now makes it more important than ever that these twin instruments of the U.S. policy be put to optimum use in helping to reduce both the monetary and the manpower burden inherent in honoring international obligations.

Many of our most willing and potentially helpful friends and allies simply do not have the resources or technical capabilities to assume greater responsibility for their own defense. Unless we help provide them further assistance, the basic policy of decreasing direct U.S. military involvement—which we are all anxious to effect—cannot be successful. The two-year authorization for military assistance contained in the Foreign Assistance Act of 1969 automatically limits to $350 million the amount which can be appropriated for the FY 1971 program. I am deeply concerned that the funds proposed for FY 1971 may not be adequate. As the President indicated in his budget message, we may well need more before the fiscal year is out.

We are conducting a thorough review of the requirements for grant aid in fiscal years 1970 and 1971. After this review is completed, the Congress will be fully informed about the nature and magnitude of any additional amounts we would propose. Any such amounts would be derived from a thorough evaluation of recommendations from responsible military and civilian officials in the field and at the State and Defense Departments, as well as the Bureau of the Budget.

Meanwhile, the illustrative program for FY 1971 must be based on the $350 million authorization contained in the Foreign Assistance Act of 1969. This anticipated new obligational authority—plus $42 million in estimated reappropriations, recoupments and reimbursements—means that a total of $392 million would be available for grant military assistance. It is important to note that a very high percentage of this total obligational authority is required to provide for operation and maintenance costs which cannot be met by recipient nations from their own resources. Therefore, the amount available for investment in new and modernized equipment is quite small.

Programs for most of the recipient nations already are so modest that it is generally impossible to make any significant reduction in them without negating the whole purpose of the assistance. It has, therefore, been necessary for the substantially larger programs to absorb practically all of the reduction required by cuts in the Administration's budget request for the past several years. As a result, it has been impossible to provide equipment to replace the worn out and obsolescent materiel which is increasingly degrading the combat capabilites of allied forces upon whom we rely as an integral part of our partnership in security.

It is also the policy of the Administration—and indeed it is a matter of law—that we should move our military assistance from a grant to a sales basis as the economies of recipient countries become stronger and more able to support a larger share of their burden. However, we do not wish in any way to hamper their development and thus we are providing credit to ease this transition. The Foreign Military Sales Act which authorizes sales—both cash and credit—is therefore an important instrument of U.S. policy—complementing and eventually supplanting the Military Assistance Program.

All Foreign Military Sales transactions, both cash and credit, are rigidly controlled in order to ensure that they are fully consistent with U.S. foreign

policy interests, and that they will neither increase regional tensions nor encourage arms races. When a proposed purchase meets the very strict criteria established both by law and by the Executive Branch, it is clearly in the national interest to provide credit financing to facilitate the sale. These actions relieve some of the pressure on the limited funds available for grant assistance.

The Administration requested $275 million in FY 1970 for Foreign Military Sales and is asking for $272.5 million in FY 1971 to assist in the financing of defense articles and services. The fact that no final action has been taken by the Congress on FMS legislation for the current fiscal year lends strong emphasis to the need for prompt completion of the legislative process for FY 1970 and for favorable consideration of the Administration's proposals for FY 1971.

General Purpose Forces Program for FY 1971

We plan to have 29-1/3 active and reserve Division Force Equivalents at end FY 1970, 3-1/3 less than at the end of FY 1969. However, because of the uncertainties surrounding deployments in Southeast Asia beyond April 15, 1970, we cannot project the detailed structure of our Land Forces for FY 1971. The active Army will decline from 19-2/3 Division Force Equivalents at end FY 1969 to 17-1/3 at end FY 1970 and the active Marine Corps will be reduced from 4 divisions at end FY 1969 to 3 by the end FY 1970.

In FY 1971 we are proposing a force of about 8,300 tactical aircraft, including about 4,600 active fighter/attack aircraft organized into 85 squadrons (23 wings) in the Air Force, 72 squadrons in the Navy (15 attack carriers), and 25 squadrons in the Marine Corps (3 wings).

The major active naval forces which we propose to maintain in FY 1971 include 15 attack carriers, 4 ASW carriers, 52 nuclear and 53 conventional attack submarines, over 500 ASW aircraft and 242 escort ships.

I want to comment on two items that have been of particular concern to me, the F-111 procurement program and the attack carrier program.

Selected General Purpose Forces Programs FY 1971

	($ Millions)
Land Forces	
Continued Development of SAM-D, a New Surface-to-Air Missile	89
Development of New Austere Main Battle Tank	77
Procurement of Helicopters (UH-1s, CH-47s, AH-1s, OH-58s)	197
Procurement of TOW Anti-Tank Missiles	106
Procurement of Improved Hawk and Chaparral Missiles	168
Tactical Air Forces	
Development of F-15 Air Superiority Fighter	370
Development of A-X Close Air Support Aircraft	28
Procurement of F-111s (or alternative aircraft)	484
Development and Procurement of F-14 Multi-Mission Fighter	841
Procurement of AV-6Bs (Harrier) V/STOL	96
Procurement of A-7 Attack Aircraft	350
Naval Forces	
Advanced Procurement for the Third Nimitz-Class Attack Carrier	152
Development and Initial Procurement of the S-3 Carrier Based ASW Aircraft	287
Continued Procurement of the P-3C Land-Based ASW Aircraft	160
Development of a New Ship Air Defense System	75
Construction of:	
3 High Speed Submarines	476
1 Nuclear-Powered Guided Missile Destroyer	221
6 ASW Destroyers	460
2 Multi-Purpose Amphibious Assault Ships	314

Figure 7.

F-111 Program

In developing the FY 1971 budget, we had planned to acquire enough F-111 aircraft to complete our planned force goal. Accordingly, we included in the budget a total of $484 million for F-111 procurement—$283 million for additional procurement of F-111Fs and $200.5 million for payment of prior year over target costs. In addition, we have included $16.5 million for the modification of 10 research and development aircraft to a tactical configuration.

I am sure that the Committee shares my long-standing concern over the F-111 program, particularly in light of the difficulties that have been encountered. For the time being, we have retained in the budget request the planned funding for the F-111s noted before. However, I have asked the Secretary of the Air Force, in connection with an investigation of recent structural and operational difficulties, to examine in detail the alternatives to procuring F-111s in FY 1971. I have postponed a final decision on this matter until this action is com-

pleted by the Air Force.

I believe we do need in our tactical air force structure the capability available in the F–111, but I also believe that if we are going to be plagued with a continuation of these problems we must explore other alternatives.

In the event that we decide not to proceed with the additional procurement in FY 1971, we would need to use the funds included in the budget to cover existing F–111 charges and to procure appropriate replacement aircraft.

As you know, we must also consult with the Australian Government on any modifications to the F–111 contract, because it may have an impact on their planned procurement. The Australians had previously agreed to take delivery of the 24 F–111Cs built for them, provided that we incorporate at our expense any necessary structural fixes, even after the aircraft have been delivered.

Attack Carrier Program

Two Nimitz-class nuclear-powered attack carriers (CVAN) have been authorized and funded to date. These two ships (CVAN 68 and CVAN 69) will be built on the same design plans and under the same multi-year contract, which may also contain an option for a third ship. The Navy is currently negotiating a fixed price incentive fee type contract with the shipbuilder, which will establish target and ceiling prices for the first two ships and perhaps for the third ship. Budgeted costs are $536 million for Nimitz and $510 million for CVAN 69 (excluding outfitting or post-delivery costs). However, negotiations are now underway and the Navy informs me that they could result in higher costs. . . .

Included in the FY 1971 budget is $152 million for advance procurement of long leadtime nuclear components and propulsion equipment for the third Nimitz-class carrier, CVAN 70. I want to assure the Committee, however, that none of these funds will be obligated until the study required by the FY 1970 Authorization Act has been completed by the two Armed Services Committees and until we have completed our own current review, in the Executive Branch, of future force requirements. The Navy estimates that if the remainder of the funding for the CVAN 70 is provided in the FY 1972 program, the target end cost of the ship will be about $640 million (excluding outfitting or post-delivery costs) based on estimated FY 1972 labor and material dollars, including escalation reserve based upon 10 percent of the estimated shipbuilder's contract.

Also included in the FY 1971 budget is $21 million to complete funding of a spare set of nuclear components for all Nimitz-class ships; $39 million was provided in FY 1969 and $48 million in FY 1970 for this purpose.

* * * * *

Appendix C

General Purpose Forces Threat

Over the past year, we have seen the Soviet and East European General Purpose Forces continue their growth both in quality and in quantity. The total forces available are described below.

Soviet Union

At the present time, all of the Soviet ground divisions deployed in Eastern Europe are combat-ready. A considerable number of divisions in the Soviet Union, including several airborne divisions, are also considered either fully ready or in a state that would permit very rapid mobilization. A large number of Soviet divisions are only partially equipped and manned, but could be brought up to strength with reservists and augmented with civilian vehicles, and deployed in a relatively short time. The remainder of the Soviet divisions are believed to be in a caretaker or cadre status.

A high density of tanks, many of which are over 15 years old, provides the Soviets on all fronts with heavy direct fire support, in place of conventional artillery. However, recent changes have resulted in a substantial increase in the number of artillery tubes available to the Soviet ground forces. Nevertheless, Soviet techniques for the employment of artillery are not up to U.S. standards. The Soviets also emphasize tactical ballistic missiles and rockets in support of their general purpose forces, and training exercises indicate such weapons would be used. At the present time, two types of tactical ballistic missiles are deployed.

Soviet tactical doctrine apparently calls for all infantry to be mounted on amphibious armored personnel carriers. In this area, however, the Soviets are deficient.

In tactical aviation, the Soviets have several thousand fighters and light bombers in their operational units, plus some older model aircraft collocated with those units. In addition, they have a large number of combat-type aircraft in reserve and in the training establishment. Of the aircraft in operational units, about 40 percent are available for the close air support, air strike and interdiction missions, and about the same percentage for air defense. The balance is available for reconnaissance and reconnaissance strike. Almost all of the air defense elements are now equipped with the all-weather MIG–21 Fishbed, but a large proportion of the ground attack and reconnaissance aircraft are obsolescent MIG–17 Frescos and IL–28 Beagle light bombers.

Soviet tactical fighters are characterized by short combat radii and small payloads; their design and rugged construction allow them to operate from unimproved airfields. These characteristics would permit a high sortie rate from improved bases where sufficient logistics and maintenance support were available. Soviet tactical air doctrine, however, places heavy emphasis on operations from dispersed unimproved airfields; from such airfields the sortie rate would be lowered.

Soviet theater air defenses, particularly in Eastern Europe opposite the Central Region of NATO, have received increased attention in improved equipment and facilities. The improvements have included the continued deployment of the all-weather MIG–21. In their ground environment the Soviets have made a substantial effort to improve their low-altitude surveil-

lance and tracking capabilities with tower-mounted radars. The Soviets have also constructed and continued to construct hardened shelters for their aircraft and some radars, and have resumed the use of extensive and sophisticated camouflage as part of a program to improve the survivability of their forces.

The Soviets are continuing their efforts to improve the capabilities of their tactical aviation and their current developmental program would indicate that at least three new aircraft would be available within the next several years—the swing-wing Flogger, the Foxbat and a V/STOL. Prototypes of these aircraft were exhibited by the Soviets in the summer of 1967.

Soviet tactical aviation also provides light troop transport and utility support for theater ground forces. Although the Soviets appear to recognize the value of armed helicopters, there is no evidence of a helicopter designed specifically for this type of mission. However, some of their existing helicopters appear to be armed with weapons that would be consistent with an armed helicopter role, such as machine guns, rockets, and anti-tank missiles.

The main intertheater lift for theater forces is provided by AN-12 Cub medium transports which have as a main mission the support of airborne troops. Some Cub aircraft have improved range and weight-carrying capabilities.

The Soviets have developed and stockpiled a range of nuclear weapon types for their theater forces. In addition, it appears that toxic chemical agents, including nerve gases, have been developed for use in theater warfare. Soviet forces are also well organized, equipped and trained for defensive chemical warfare.

In the past, the principal and traditional tasks for Soviet General Purpose Naval Forces have been oriented toward the defense of the homeland, including interdiction of sea lines of communication and local area antisubmarine warfare (ASW). More recently, however, we have noted increasing use of the Soviet Navy for politico-military purposes abroad, including deployments to the Indian Ocean and the Caribbean, and over the years a decided strengthening of their Mediterranean squadron.

The Soviets apparently are concentrating on improvements in quality in their naval forces, including improved antisubmarine warfare and air defense. Perhaps the most significant area of concentration is the Soviet submarine construction program. The Soviets in the last few years have developed several new general purpose submarines which are probably now in series production.

At the present time the Soviets have close to 60 general purpose nuclear submarines operational, including more than 30 equipped with cruise missiles. Further growth in this nuclear-powered submarine force is anticipated, but the Soviet diesel submarine force is expected to decrease. It is estimated that the annual construction of Soviet attack submarines could reach 10–14 units, of which a large percentage would be nuclear powered, by the early 1970s. The addition of new attack submarines will be more than offset by the retirement of numerous older medium-range units, but the proportion of nuclear and long-range diesel units will increase substantially.

The Soviet surface forces are also improving in capability, particularly with the deployment of new light cruisers equipped with both surface-to-air and surface-to-surface missiles, and new or converted destroyers with surface-to-air missiles. Although we expect the overall strength of the Soviet surface force to remain relatively constant, we do expect in the near future the replacement of some older ships with missile armed ships.

Although Soviet Naval Air Forces, with the exception of ASW helicopters assigned to the helicopter ships, are land-based, they are a significant and capable component of Soviet naval forces. At the present time, these forces consist of patrol and ASW aircraft (including helicopters) plus medium and light bombers, some of which are equipped to carry air-to-surface missiles.

In general, Soviet naval forces appear to be designed to combat U.S. carriers, logistics ships and submarines. The Soviets are increasingly moving out into open ocean areas, particularly for training exercises related to improving ASW capabilities. In addition, we have noted several out-of-area deployments by Soviet attack submarines, including one into the Gulf of Mexico, and operations in the Mediterranean and the Indian Ocean. Of course, the continued stationing of Soviet intelligence collection ships in the vicinity of U.S. Polaris submarine bases emphasizes their concern about the U.S. nuclear-powered submarine force.

The general trend toward more out-of-area operations is supported by the construction of longer-range combatants and a general upgrading of the naval support organization. However, this support organization remains limited, and in the interim period we believe that the Soviets will continue to use facilities made available by countries such as the United Arab Republic and Syria.

Eastern Europe

In addition to the Soviet forces just covered, the ground troops of East European countries number over 800,000 men. The organization and equipping of these forces is very similar to that of their Soviet counterparts, and many of their divisions must be filled with reservists in the event of mobilization.

There are also available in Eastern Europe a large number of combat aircraft, mostly interceptors. Some of these aircraft are new models, such as the MIG-21, and almost all aircraft delivered by the Soviets to Eastern European countries during the past two years have been the all-weather MIG-21 interceptors.

Although the indicated strength of the East European forces is significant, it should be recognized that events of the past year or so focused attention on the question of their political reliability and availability in the event of armed conflict with the West. For example, a significant number of the troops and aircraft are Czechoslovak, and certainly the currents of nationalism in Hungary, Rumania, and elsewhere in Eastern Europe could raise some question for the Soviets regarding the political reliability of those forces in a conflict. However, prudence demands that we take account of them in our planning.

Asia

Turning to the Pacific, the non-Communist nations in that area are, in general, faced with a different type of threat.

North Korea is a militarily strong country that has demonstrated a dangerous aggressiveness and hostility toward South Korea and the United States. It has some 350,000 troops and an effective air force of more than 500 combat aircraft (including MIG-21s). And Communist China, of course, has a massive army of close to 2½ million troops and an air force of over 2,900 jet fighters. While the Chinese have proclaimed a general line of armed revolution in Asia and actively propagandize against "U.S. imperialists" and "puppet governments," they seem to be careful to avoid involvement of their own personnel in military operations associated with the so-called "liberation movements." Moreover, their current difficulties with the Soviet Union may serve as a restraint to any major military operations outside their own borders.

We cannot overlook the fact that these Asian Communist states, in relation to their neighbors, command large and powerful military forces. These forces must be taken into account in our planning. We must also be prepared to meet the emerging nuclear threat from China, which was discussed in some detail in the section on Strategic Forces.

The principal threat to the nations in Asia is internal insurgency, supported by external assistance. This is an important aspect of the threat to which our general purpose force planning with our allies in that area should be oriented.

Appendix D

U.S. General Purpose Force Programs for FY 1971

Land Forces

The General Purpose Land Forces planned for end FY 1970 are summarized in a classified table furnished to the Committee. Because of the uncertainties surrounding our deployments in Southeast Asia beyond April 15, 1970, we cannot project the detailed force structure for FY 1971.

We plan to have 29⅓ Division Force Equivalents at end FY 1970, 3⅓ less than at the end of FY 1969. This reduction reflects the withdrawals of U.S. forces from Southeast Asia already announced by the President and our re-evaluation of land force requirements.

The proposed reductions apply solely to the active forces; the reserve forces remain unchanged—eight Army and one Marine Corps divisions. The active Army will decline from 19⅔ Division Force Equivalents at end FY 1969 to 17⅓ at end FY 1970, a total reduction of 2⅓ Division Force Equivalents. The active Marine Corps will be reduced from four divisions at end FY 1969 to three by end FY 1970.

We are proposing considerably higher military personnel end strengths for both Services at end FY 1971 than they had at the end of FY 1965—Army 1,239,582 compared with 969,066, and Marine Corps 241,185 compared with 190,213.

* * * * *

It should be emphasized that these figures should be considered highly tentative, especially for 1971, since some adjustments between Army and Marine Corps may well be in order during the forthcoming year. It is for this reason that we are requesting an increase from $200 million to $300 million, in the transfer authority provided by Section 634 of the FY 1971 Department of Defense Appropriation Bill. This is the General Provision which authorized the Secretary of Defense, if he deems it vital to the security of the United States, to transfer funds from one defense appropriation to another, but not to exceed the total amount stated in the law.

Army Division and Brigade Forces

The principal change in the active Army's major force structure is in the number of infantry divisions, which declines from seven at end FY 1969 to 4⅔ at end FY 1970. The balance of the actual division force structure remains unchanged—one airborne, two airmobile, four mechanized, and four armored divisions, and five independent brigades. The mechanized and armored divisions are oriented principally to our NATO requirements.

No change is proposed in the composition of the division structure of the Army Reserve components.

* * * * *

We expect that future redeployments will further reduce the Army's active division/brigade force structure in FY 1971.

Army Supporting Forces

The Army combat support forces—such as field artillery and combat engineers, etc.—will be reduced in consonance with the reduction in divisions and brigades. We are retaining, however, a large proportion of the aviation units, which have proved to be so useful in South Vietnam.

With regard to the Army surface-to-surface missile forces, there is little change from the program presented by Secretary Clifford last year. A new surface-to-surface missile, Lance, has been under development for a number of years to replace the Honest John and Sergeant missiles now in the force. The Army now believes the problems encountered with the fuel system for this missile have been solved. Accordingly, we are requesting funds for the procurement of 55 Lance missiles in FY 1971. These missiles will be used principally for inventory and training. The first Lance battalion is scheduled to be deployed in the early 1970s.

The entire Army surface-to-surface missile program, which originally contemplated the retirement of all of the Sergeant and most of the Honest John battalions, will be thoroughly reviewed in context with the FY 1972-76 program.

With regard to surface-to-air missiles, we are planning essentially the same Army Hercules program presented last year. However, we intend to reduce the number of active Army Hawk batteries. A large part of the decrease should be offset by the conversion of several towed battalions to self-propelled and the eventual deploy-

ment of Improved Hawk.

The buildup of Chaparral/Vulcan batteries is proceeding somewhat more slowly than contemplated last year, nevertheless, we should have a substantial number of these batteries at the end of the current fiscal year and more by the end of FY 1971.

With regard to SAM–D, the potential replacement for both the Hercules and Hawk, we have decided to continue the program in advanced development for another year. About $89 million has been included in the FY 1971 budget for this purpose.

Marine Corps Division Forces

In FY 1970, we are deactivating the 5th Marine Division which was reactivated during the early stages of the Vietnam buildup. The 3rd Marine Division was redeployed from Vietnam last November with two brigades going to Okinawa, and one brigade to CONUS. . . .

Except for the helicopter units, the changes in the Marine Corps forces in FY 1970 are related essentially to the reduction from four to three active divisions. Last year the Marine Corps planned to have three medium CH–46 squadrons, two heavy CH–53 squadrons and one light observation squadron in each of the air wings (three active and one reserve), plus four training squadrons, for a total of 28.

During the past year, AH–1G/J Cobra gunship helicopters have taken over a mission formerly performed by armed UH–1 helicopters. In addition, each wing will be provided one light transport (UH–1E/N) squadron. Three of these squadrons are already in the force, and one more will be provided for the Marine Corps reserve wing.

Procurement

There are a few items which I would like to highlight at this point.

The first concerns the Army tank program. As this Committee is well aware, the Army has experienced considerable difficulties in advancing their tank technology. The standard M60 tank (the A–1 model with a 105mm gun) is a well proven and successful weapon system. It now constitutes the backbone of the Army's armored forces, particularly in US.-NATO-oriented forces.

The Army's attempt to improve that vehicle by incorporating a new Shillelagh missile/152mm gun system, however, has not been successful. The 300 M60 A1E2 tanks with the new missile/gun turrets, which were purchased in FY 1967, are still not usable in their present configuration. Neither are the 243 separate turrets which were to be retrofitted on standard M60 tank hulls. The Army now believes that the turret stabilization problem can be corrected relatively soon, but that the reliability problem will take longer to solve. Inasmuch as the increased effectiveness which could be provided by these tanks is needed, we believe an additional effort to see what would be required to correct the deficiencies is warranted. Accordingly, $3.8 million of FY 1970 funds has been allocated to this effort and another $12.1 million is included in the FY 1971 budget for this purpose.

The Army's efforts to develop an entirely new Main Battle Tank (MBT–70) jointly with the Federal Republic of Germany have also run into difficulties, and these were extensively discussed with the Congress last year. . . . The technical problems still to be resolved are not considered insurmountable. However, the average unit cost for a tank with all the features contemplated in the MBT–70 would be at least $850,000 for the quantity needed to equip the Europe-positioned forces. We can buy a new M60A1 today for under $300,000 per tank, and the greater combat effectiveness promised by the MBT–70 simply does not justify so great a differential in the cost.

Several studies over the past few months have indicated that it should be possible to produce a tank with the more important features of the MBT–70 at a cost of under $600,000 per tank, for the same quantity. Such a new tank would still be markedly superior to any the Soviets are likely to field through the 1980s, since it would include spaced armor, improved mobility and agility, both missile and gun armament, a load and shoot on-the-move capability and an ability to fight at night.

The tank now proposed would make maximum use of components already developed, such as the hydro-pneumatic suspension system, and emphasize reliability and durability, as well as the need to hold costs down. The next six months will be devoted primarily to further intensive cost tradeoff studies to determine the preferred configuration of the tank, after which work will begin on a limited number of prototypes (6 to 12). This approach should provide the basis for a firm, fixed price production contract. We are requested $77 million for research, development, test and evaluation (RDT&E) and advanced production engineering in FY 1971.

There is another aspect to the MBT–70 problem as well, that has to do with the joint development program with Germany. We now feel that it would be best for both countries to pursue work on a new tank separately. Accordingly, we began negotiations in January which should enable us to reach a memorandum of understanding with the Germans on the termination of the joint program. Although the joint program will be formally ended, we expect that both countries will continue to provide support to each other's program.

Because any new main battle tank developed over the next few years will not be available for equipping the forces until the mid-1970s, we believe the M60 production line should be continued at the minimum sustaining rate at least through the FY 1971 funding period. Accordingly, we are including funds in the FY 1971 budget for the procurement of 360 vehicles, including 300 M60A1 tanks, 30 armored vehicle-launched bridges and 30 combat engineer vehicles. The tanks will be used to upgrade our existing inventory.

The final procurement of the Sheridan armored reconnaissance vehicles will be made in FY 1970. . . . We are requesting $4.4 million in FY 1971 to complete contractor support of the FY 1970 procurement and modification program.

The Shillelagh anti-tank missile program will also be bought out in FY 1970, pending the outcome of the test of this missile in the infantry ground and helicopter modes which the Congress has directed. I would like to point out, however, that the Shillelagh

missiles we are buying are designed for closed breech launch from an armored vehicle such as the Sheridan or the M60A1E2, where recoil, muzzle blast and weight are inherently secondary considerations. The TOW heavy anti-tank missile, in contrast, is specifically designed for use on the ground by infantry troops and in helicopters. Whether a Shillelagh launcher suitable for use in these modes can be successfully designed has yet to be demonstrated. Moreover, we do not know how long it would take to develop such a launcher.

Given these uncertainties, we are recommending continued procurement of TOW in FY 1971. About 5,500 were bought in FY 1969, principally for service testing and training. More will be bought in FY 1970, and we are requesting funds in the FY 1971 budget for additional procurement.

The Dragon medium anti-tank missile will be continued in development for another year, and funds are included in the FY 1971 budget for this purpose.

Last year, because of difficulties encountered in the test program, we cancelled the procurement of the new AH-56 Cheyenne compound helicopter, and instead purchased 170 AH-1 Cobras. Since no satisfactory solution has yet been found to the Cheyenne problems, we propose to continue procurement of AH-1s to meet the Army's armed helicopter requirements, and funds for 70 more of these aircraft are included in our FY 1971 request. We have also included $17.6 million in the Army's RDT&E account to continue the development and test of the Cheyenne.

We also propose to buy in FY 1971 another 600 OH-58 light observation helicopters to continue the modernization of Army observation units, as well as 120 UH-1s and 24 CH-47s for attrition replacements.

With regard to Marine Corps helicopters, we have made several adjustments to the FY 1970 procurement program in the last year, mainly to reflect actual combat attrition experience in Vietnam. Last April we eliminated the planned procurement of 24 CH-53D heavy transport helicopters and reduced the CH-46 medium transport helicopter buy from 72 to 60. We have now reduced the FY 1970 CH-46 buy from 60 to 12, all of which will be used to replace combat losses.

Last April we proposed the purchase of 22 UH-1Ns for the Marine Corps in FY 1970 in order to replace combat losses and maintain the inventory. These aircraft were to be bought in addition to the 40 UH-1Ns provided in the FY 1970 budget for the Navy. We have now determined that the Navy requires only 30 of these helicopters through FY 1971 for combat support and command and control. Accordingly, we propose to apply the other 10 to the Marine Corps requirement, leaving 15 more to be procured in FY 1971. These 47 UH-1Ns should be enough to replace combat losses, and form the one additional light transport squadron I discussed earlier in connection with the Marine Corps helicopter forces.

Tactical Air Forces

We expect to have a force of about 8,300 tactical aircraft at the end of FY 1971, compared with 8,500 at the end of FY 1970 and 8,700 at the end of FY 1969. Even so, we will have about 800 more tactical aircraft than we had at the end of FY 1965, before large U.S. forces were deployed to Southeast Asia. In addition, we will have many newer and more capable aircraft.

Active Fighter/Attack Forces

We now plan to maintain about 4,600 fighter/attack aircraft in the active forces at end FY 1971, compared with about 4,900 at end FY 1970 and about 5,000 at end FY 1969.

Air Force. The Air Force tactical air structure will be continued with little change through FY 1971, and will include 23 wings of F-4s, F-111s, A-7s, F-100s, and F-105s.

Included in the FY 1971 budget is a total of $484 million for F-111 procurement—$283 million for additional F-111F aircraft and $200.5 million for payment of prior year over target costs. In addition, we are requesting $16.5 million for the modification of 10 F-111 research and development aircraft to a tactical configuration.

The first wing of A-7s will be operational in FY 1971, as planned a year ago. A total of 202 A-7s has been provided through FY 1970, and funds are requested in the FY 1971 budget for the procurement of 88 more.

As explained last year, the buildup of F-4 squadrons will be completed in FY 1970. No procurement was planned for FY 1970. However, 24 F-4s need to be procured in FY 1971 to replace combat losses and sustain the approved force level.

A number of other adjustments were made in the fighter/attack forces last year in connection with our efforts to reduce FY 1970 expenditures. The FY 1970 buy of A-37Bs was reduced from 96 to 36, and we do not plan to procure any more in FY 1971. The A-37s now in the active forces will be transferred to the Reserve Forces, beginning in FY 1970. Six, instead of four, squadrons of F-102s will have been dropped from the active force by the end of FY 1971; the two remaining squadrons will be retained through the end of FY 1971; one in Iceland and one in the Pacific.

Finally, an F-100 wing will be phased out of the active forces in FY 1971.

The development of the F-15, the Air Force's new air superiority fighter, is proceeding on schedule. We still plan to optimize this aircraft for air-to-air combat, and we believe its performance will be superior to any present or postulated Soviet fighters in both close-in visual and long-range missile encounters.

Several new developments now underway will be used in the F-15, including the new joint Navy/Air Force-funded advanced technology engine which will provide a major increase in thrust relative to weight, the new short-range high maneuverability missile, and the new 25mm gun which uses caseless ammunition. Equipped with the new missile and gun, as well as the advanced Sparrow and good sensors, the F-15 with its twin high-thrust engines should prove to be a major advance in fighter aircraft.

The Air Force's present program calls for the first flight of a research and development aircraft in calendar 1972, and an initial operational capability in the mid-1970s. A total of 20 RDT&E aircraft is now contemplated,

however, the last 7 will not be instrumented and, thus, can be placed in the operational inventory after the test program is completed.

Although we feel it is not economically feasible to develop the entire aircraft on a competitive basis, as has been suggested by some people, we are planning to conduct competitive development of high-risk subsystems, such as the new gun, missile, engines, and radar. The F–15 engineering development contract, with production options, was awarded in late December 1969, and a total of $370 million has been included in the FY 1971 budget for this program.

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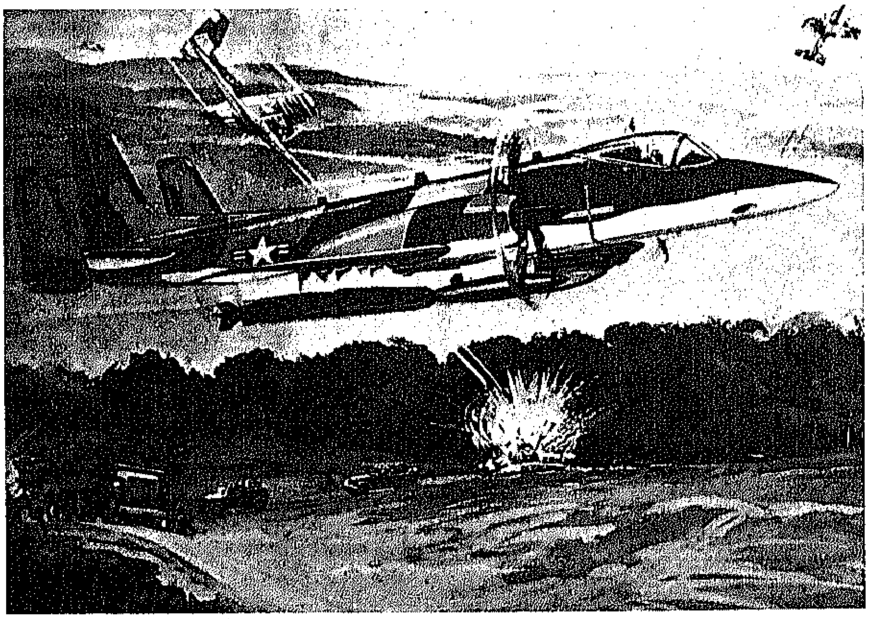
We also plan to go ahead in FY 1971 with the development of a new close air support aircraft, the A–X. The Congress provided $2 million for this program last year to begin contract definition. However, we now believe it may be more desirable to go directly to prototype development on a competitive basis. The cost of a sole source contract definition and engineering development program for 10 test aircraft (7 of which could later be modified to a tactical configuration) is estimated at about $155 million. We believe a two-contractor competitive program involving the construction of two prototype aircraft each, and no further development could, under current estimates, be done for considerably less.

The competitive approach would provide test aircraft about one year earlier, and would allow a decision on whether to procure the aircraft, as well as the selection of a producer, to be based upon competitive testing of actual hardware rather than paper designs. If we then decided to buy the aircraft, the winning contractor would complete the engineering development and build the necessary 10 research and development aircraft. A competitive research, development, test and evaluation program will, of course, involve greater costs than a sole source program.

What we are seeking is an aircraft more capable than the A–37 or OV–10 but less costly than the A–7 or F–4. An essential part of the prototype approach is to allow the contractor a wide latitude in his choice of design, engines, etc., in meeting this general objective. A total of $27.9 million has been included in the FY 1971 budget to begin prototype development with two contractors.

One other program, which is of interest to the Committee, is the international fighter. During the past year we have identified a definite need to provide an increase in the air-to-air capability of the South Vietnamese Air Force against the North Vietnamese threat. In addition, we believe that making an appropriate aircraft available to South Korea, Taiwan, Thailand and other allies could provide a means for these nations to shoulder more of the burden of their own defense.



We also plan to go ahead with the development of the A-X.

Although we have not yet determined the most appropriate aircraft for this mission, we are currently studying the possibility of using an improved version of the F–5, a stripped down version of the F–4, or some other aircraft. A request for proposals will soon be issued, and the final selection will be made on a competitive basis. The appropriate Congressional Committees will be kept advised. Some $28 million from the Air Force resources was made available last year and will be used for this program in FY 1970; another $30 million is requested in FY 1971.

Navy and Marine Corps. Last year it was planned to operate 80 active squadrons (1,680 aircraft) and 16 attack carriers (CVAs), including one antisubmarine warfare carrier (CVS) serving as an attack carrier through the end of the Vietnam war, and then drop to 70 squadrons (1,350 aircraft) and 15 attack carriers. We now plan to operate 72 squadrons (1,430 aircraft) and 16 attack carriers (including the CVS) through the end of the Vietnam war. With the phase down in Southeast Asia deployments already initiated, Marine Corps tactical aviation can augment Navy air wings as necessary to compensate for the reduced number of Navy squadrons in the force. As you know, the post-Vietnam requirement for attack carriers is under study and will be addressed in connection with our submission on the FY 1972 budget.

The number of fighter squadrons will remain unchanged. No further F–4 procurement will be required in FY 1971.

The increase in authorized aircraft inventory for A–6s for FY 1971 involves principally a bookkeeping change rather than an increase in the number of squadrons. Certain special purpose A–6s employed in Southeast Asia had not heretofore been included in the authorized active inventory or in the squadron unit equipment (U.E.). The FY 1971 budget includes funds for the procurement of 12 more A–6Es for attrition. The first 12 of this model, with improved avionics

and more powerful engines, were procured in FY 1970.

The buildup of A–7 squadrons should be completed during FY 1971. However, 30 A–7Es will be procured in that year for advanced attrition, before production of this model ceases. At the same time, we plan to reduce the unit equipment per squadron because of the increased capability which the A–7s should provide over the A–4s that they are replacing.

With the increase in A–7 squadrons in FY 1971, the number of A–4 squadrons will be reduced.

The multi-mission F–14 fighter development program, along with the Phoenix missile, is proceeding on schedule. An F–14 fixed price incentive engineering development contract, with options for the purchase of production aircraft, was signed on Feb. 3, 1969. A total of 12 test aircraft has been authorized under the research, development, test and evaluation account through FY 1970, and we are requesting a total of $517 million in the FY 1971 budget for the procurement of 26 aircraft and the additional tooling required to increase the production rate in future years, plus $141 million for initial spares and long leadtime items for aircraft to be bought in FY 1972. However, no production rate increase will be approved until we have had a chance to evaluate the plane in flight. Another $92 million is requested FY 1971 to procure 72 Phoenix missiles for the test program.

The principal change in the Marine Corps active fighter/attack forces in FY 1971 is the reduction in F–4 squadrons. This reduction relates in part to the introduction of the AV–6B Harrier, and in part to the Marine Corps' desire to increase the helicopter forces, described earlier, by using funds that would have supported the F–4 squadron.

It was decided last year in the amendments to the FY 1970 budget, to procure an initial quantity of 12 Harriers for the Marine Corps, instead of another 17 F–4s. In order to provide enough aircraft for one complete squadron and a training nucleus, we propose to buy 18 more Harriers in FY 1971 and are requesting $96.2 million for that purpose, plus $22.1 million for initial spares and advance procurement for aircraft to be purchased in FY 1972. Now that we have decided to move ahead with this program, and in view of the Congressional desire to produce the aircraft in the United States, we have included $24.2 million (within the $96.2 million) to provide for the cost of partially assembling the 18 aircraft in this country under a licensing arrangement. This $24 million would not be required if we were to continue procurement directly from the United Kingdom.

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Although the first squadron will not be fully equipped until the early 1970s, we should receive the first few Harriers for service test in FY 1971. This V/STOL close support jet will provide the capability to operate from amphibious ships or forward sites ashore, close to the ground troops.

Reserve Fighter/Attack Forces

In addition to the fighter/attack aircraft in the active force, we now have about 950 in the reserve forces.

Air National Guard. A year ago a FY 1970 force of 24 fighter squadrons, each with 24 unit equipment, was planned for the Air National Guard, plus one combat crew training squadron, for a total of 25 squadrons. However, we later decided to retain one more F–84 fighter squadron instead of converting it to a tactical air control squadron. Accordingly, we will have 25 fighter/attack squadrons, plus one combat crew training squadron, at the end of both FY 1970 and FY 1971.

As I noted before, the first squadron of A–37s will be transferred to the Guard during FY 1970, and during FY 1971 more A–37 squadrons will be formed. In addition, a few Air National Guard F–84 squadrons will convert to F–100 squadrons using aircraft phased out of the active forces in FY 1971, and we will also fill out the equipping of the F–100 units which do not now have their full unit equipment.

Navy and Marine Corps Reserve. The Navy and Marine Corps Reserve are now organized into 20 squadrons with about 380 aircraft. During FY 1970, two of the older A–4 squadrons are being eliminated and one more F–8 squadron is being formed, leaving a total of 19 squadrons. In addition, the Navy squadrons are being organized into two reserve attack carrier air wings, which when fully equipped, will eventually be capable of deploying aboard Hancock CVAs. The 4th Marine Air Wing composition is being modified to reflect four F–8 and five A–4 squadrons instead of the current five F–8 and four A–4 squadrons.

Reconnaissance

The Air Force reconnaissance forces remain essentially the same as planned last year. However, during FY 1971 one squadron of F–101s being reconfigured as RF–101s (financed in the FY 1969 program) will be placed into the Air National Guard rather than the active forces. The RF–101 squadron will replace one RF–84 squadron, leaving the Guard with 12 squadrons—4 RF–101, 6 RF–84, and 2 RB–57.

Because of lower than expected attrition of the RF–4s we deferred the planned FY 1970 procurement to FY 1971, in which year we proposed to buy 12.

Except for the elimination of the final procurement of the 10 RA–5Cs from the FY 1970 program, the Navy reconnaissance program is essentially the same as it was last year.

Other Aircraft

In addition to the fighter/attack and reconnaissance type aircraft, about 1,900 "other" aircraft are included in the tactical air forces—special operations, electronic and night warfare, tactical air control, airborne early warning, etc.

Last year, in our attempt to reduce FY 1970 expenditures, we reduced the special operations forces by about 30 percent. However, as explained last November, this adjustment included C–123s that were transferred to the airlift forces. No major changes are planned for this force during FY 1971.

In the electronic warfare area, the principal procurement item continues to be the EA–6B. Last April, we rescheduled production of the EA–6B, reducing the FY 1970 procurement from

19 to 12 and increasing the planned FY 1971 buy from 23 to 24. In December, the Navy successfully completed testing to determine the effectiveness of the system in a simulated operational environment. We now plan to buy eight EA-6Bs in FY 1971, and stretch out the period of time required to equip the total force.

The total A-6 program (including A-6Es, EA-6Bs, and new KA-6Ds as well as KA-6D modifications) planned last year for FY 1971 would have increased the production rate. Since the Congressional action on the KA-6D tanker program and the adjustments made in the EA-6B program last year resulted in a substantially reduced production rate for all A-6 models in FY 1970, we believe it would be advisable to maintain that rate (including KA-6D modifications) through the FY 1971 procurement period. A total of $148.7 million has been included in the FY 1971 budget for the eight new EA-6Bs, plus $43.5 million for initial spares and advance procurement, and $17.6 million for the modification of 20 more A-6As to KA-6D tankers. (Sixteen tanker conversions were funded in FY 1970.) Thus the A-6 program in FY 1971 will entail the production of 12 A-6Es and 8 EA-6Bs, plus the conversion of 20 A-6As to KA-6Ds.

In the tactical air control area, the large increase since FY 1965 in the Air Force reflects a change in philosophy in tactical air-to-ground weapon delivery. More emphasis has been placed on the need for tactical air control of air-to-ground attacks.

Navy Ship Forces

Attack Carrier Forces

As noted in the discussion of the tactical air forces, we plan to maintain 16 attack carriers in the forces through the end of the Vietnam war. This force will consist of the nuclear-powered Enterprise, eight Forrestal class, three Midway-class, three Hancock-class carriers, and one antisubmarine warfare (ASW) carrier (Shangri-La) operating in an attack role.

The modernization of the Midway will be completed this year, after more than four years in the shipyard and at a cost of $202 million (plus $5 million for outfitting and post-delivery charges). . . .

The Midway was recommissioned in January 1970, and is scheduled to be delivered to the fleet in September 1970. The Ticonderoga, which the Midway will replace, has been transferred to the ASW carrier (CVS) force.

Two Nimitz-class CVANs have been authorized and funded. These two ships (CVAN-68 and CVAN-69) will be built on the same design plans and under the same multi-year contract, which may also contain an option for a third ship.

Some $152 million has been included in the FY 1971 budget for advance procurement of long leadtime nuclear components and propulsion equipment for the third Nimitz-class carrier, CVAN-70. In addition, $21 million is requested in FY 1971 to complete funding of a spare set of nuclear components for all Nimitz-class ships. . . .

ASW Forces

The ASW forces include ASW carriers and their aircraft, attack submarines, escort ships, land-based patrol aircraft, and the sensors and weapons utilized by the ships and aircraft.

ASW Carrier Forces. The present ASW carrier (CVS) force, as has been pointed out in past years, is costly to operate in relation to its current overall effectiveness. It does, however, possess certain unique ASW capabilities and potential. But, if we desire to have a CVS force that can be effective against the qualitatively improving threat through the 1970s, its capability to detect, locate and destroy hostile submarines must be considerably improved. It is for this reason that we propose to go ahead with the development of a new carrier-based ASW aircraft, the S-3A (formerly VSX).

Although ship-based ASW aircraft are more expensive to operate than land-based ASW aircraft, they do provide the capability to extend persistent and concentrated ASW air operations into areas well beyond the range of the latter, *e.g.*, in the South Atlantic, South Pacific and Indian Oceans. Moreover, a CVS force provides a hedge against the possibility that some existing overseas stations for land-based ASW aircraft might not be available in the future.

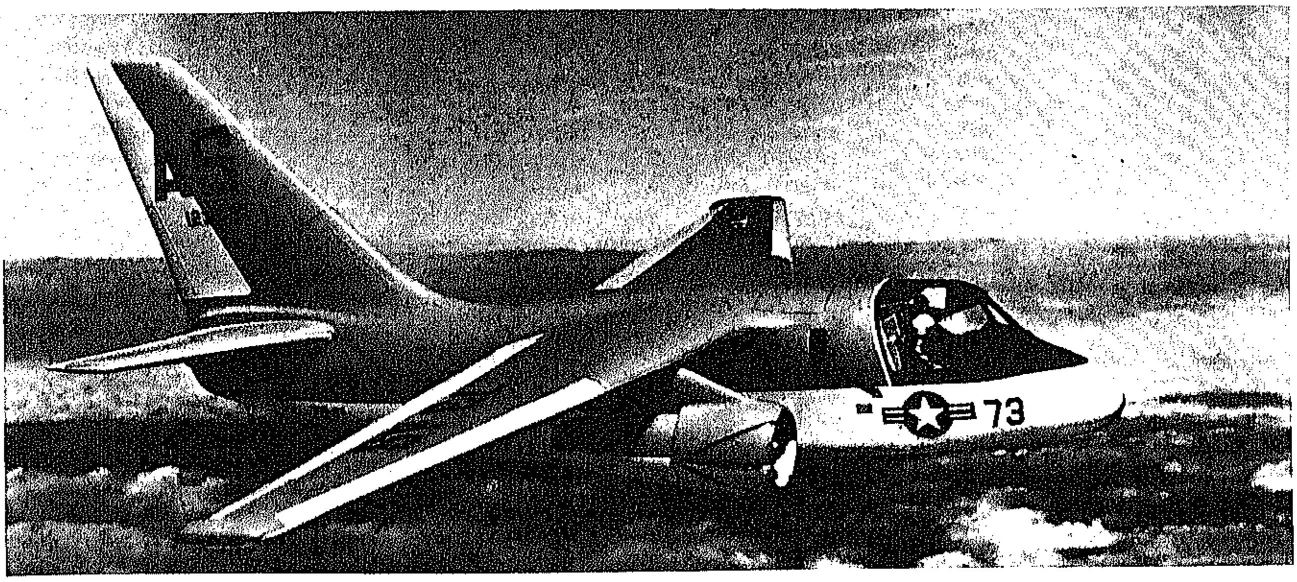
The CVS force planned a year ago included six ships and five air groups. As a result of the urgent need to reduce expenditures, we decided last summer to cut the force to four ships and four air groups by the end of FY 1970 and maintain that level through FY 1971. Beyond that point our requirements are under study. However, we are retaining the option to adjust the CVS force to whatever level may be required in the future.

The FY 1971 budget includes $208 million in research, development, test and evaluation funds to continue the S-3A development program comprising six research and development aircraft. In addition, we are requesting $79 million of procurement funds for two more test aircraft (which will be used initially in the flight test program before being reconfigured for fleet use) and the related tooling and support equipment; plus $22.7 million for long leadtime items for aircraft to be procured in FY 1971.

Patrol Aircraft. Fiscal constraints in the past year have also necessitated reductions in the land-based ASW aircraft forces. As a result the Navy has decided to phase out all of the old P-2 patrol aircraft in FY 1970, instead of over the next three years. To partially offset this reduction in FY 1970 one more P-3 squadron will be formed a year earlier than previously planned.

We tentatively plan to maintain the P-3 force at the end FY 1970 level instead of building it up over the next few years. We are less certain as to how many of the squadrons should be equipped with the new P-3C, which carries the more capable A-NEW avionics system. Several P-3C squadrons have already been funded, and our FY 1971 request provides for 12 more aircraft. We have included in the FY 1971 budget advance procurement funds for additional aircraft, in order to retain the option for building up the P-3C force beyond the presently planned level.

Although we are reducing the number of patrol aircraft squadrons be-



The budget includes $208 million to continue the S-3A development.

cause of fiscal limitations, the introduction of new sensors and, in later years, the new S-3A will result in a large increase in the quality of our total air ASW capability. Although the P-3A/B will not have the A-NEW computerized tactical plot and navigation system, it will have the same sensors and weapons as the P-3C (*e.g.*, the DIFAR and CASS sonobuoy systems and the Mark 46 torpedo) once current retrofit programs are completed.

Attack Submarines. Another critical element of our ASW forces is the attack submarine. At the end of FY 1969 we had 111 general purpose submarines—39 SSN, 62 SS, and 10 auxiliary submarines (AGSS) which were used principally for training. In view of the need to reduce FY 1970 expenditures, the Navy decided last year to phase out all of the AGSSs and add their training functions to the SS force. This change, together with the delivery of seven new SSNs, the transfer of two older SSNs to another mission, and the phase out of three SSs, will result in a force of 103 general purpose submarines, 44 SSN and 59 SS, at end FY 1970. In FY 1971, the number of SSNs should increase to 52 as new ships are delivered to the Fleet; the number of SSs will be reduced to 53 to maintain a total of 105.

Including the three submarines funded in FY 1970, a total of 71 SSNs has thus far been authorized. Of these, two have been lost (Thresher and Scorpion), one has been retired (Triton), two have been converted to other missions (Seawolf and Halibut) and 52 will be operating with the Fleet at end FY 1971, leaving 14 to be delivered in subsequent years. However, 6 of the 52 SSNs are older types which are not considered capable of meeting all operational requirements. Therefore, when the 14 new submarines are delivered to the Fleet, we will still have a total of only 60 fully-capable SSNs.

How large a fully-capable SSN force will be required during the 1970s, has been a matter of controversy for a number of years. . . .

Although we have not yet reached a firm decision on how many first-line SSNs will ultimately be required, we are convinced that at least three or four new "high-speed" 688-class SSNs should be authorized in each of the next two fiscal years, 1971 and 1972.

Last year, in addition to the funds required for the three 688-class SSNs to be started in FY 1970, the Congress provided $110 million for the advance procurement of long leadtime items for five more to be started in FY 1971. We now propose to start three in FY 1971 and $67.5 million of the FY 1970 advance procurement funds will be applied to these three submarines. The balance of $42.5 million will be applied to the FY 1972 program. Accordingly, $430.5 million will be required in FY 1971 to complete the funding of the three SSNs to be started in that year, and $45 million (in addition to the $42.5 million provided in FY 1970) is requested for advance procurement for the submarines to be started in FY 1972.

Preliminary design of the new 688-class SSN was performed by Newport News Shipbuilding and Dry Dock Co. The Navy plans to contract for the detailed design and working plans, as well as the construction of the lead ship, with Newport News on a sole source basis early in 1970. The follow-on ships will be built under a multi-year contract now scheduled to be awarded on a competitive basis in the summer of 1970.

Escort Ships. Last year, in order to reduce operating costs, the Navy decided to phase out 36 more of the older ASW escort ships than had previously been planned. This, plus a delay in delivery of some new destroyer escorts (DE), will reduce the end FY 1970 force to 166, compared with 208 planned a year ago.

In FY 1971, 13 old destroyers (DD) and 2 radar picket escorts (DEP) will be phased out as 14 new DEs are delivered to the Fleet. In addition, the last four DD-931 class ships currently undergoing ASW modernization should return to the Fleet in FY 1971, making a total of 169 ASW escorts by the end of the fiscal year.

The level of guided missile cruiser

and destroyer types in FY 1970 will be the same as that planned a year ago—70 active ships plus 4 in modernization. We plan to maintain about this same force level through FY 1971.

The escort shipbuilding program has gone through a number of major changes in recent years, principally as a result of rapidly escalating cost estimates. The revised program proposed by the outgoing Administration in January 1969 provided for the construction of 30 DXs, 28 DXGs and 4 DXGNs, although construction of DXGs was not proposed in the budget. It has been decided to go forward at this time only with the DX (now designated DD-963 class) and DXGN (now designated a nuclear-powered guided missile frigate, DLGN-38) programs.

The Congress last year provided $317.7 million to complete the funding for the first five DD-963s ($25 million for advanced procurement had been provided previously), plus $17.6 million for advance procurement for ships to be started in FY 1971. It now appears that the cost of the DD-963 will be considerably higher than estimated even last year—about $480 million for the first five, compared with about $343 million. In order to keep this program fully funded we have now decided to start with three ships in FY 1970 at an estimated cost of $308.6 million, and hold the FY 1971 buy to six ships at an estimated cost of $506.8 million, instead of the nine planned last year. Of the $360.3 million thus far provided by the Congress for this program, $308.6 million will be applied to fully fund the first three ships and $51.7 million will be used for advance procurement for ships to be started in FY 1971 and FY 1972. Another $459.5 million is included in the FY 1971 budget to complete the funding of the six FY 1971 ships.

We believe this slower construction schedule is more realistic in view of the present status of the program. The competitive contract definition effort on this ship has been essentially [illegible] Navy is in the final [illegible]otiation. A mul[illegible] [illegible]ntract, is ex[illegible] [illegible]e of the two [illegible], Bath Iron [illegible]ing. Either one of these contractors would have to undertake a substantial expansion of his work force, and this could best be accomplished gradually.

The DLGN-38 program has also experienced an increase in estimated cost over the past year. The estimate for the first ship is still the same, $222 million, but the next three ships are now expected to cost an average of about $208 million, compared with the $180–$190 million estimated last year. Thus far, the Congress has appropriated $325.9 million for this program. Of this amount, $222 million is being applied to fully fund the first ship and $31 million will be applied for advance procurement for the second ship to be started in FY 1971, leaving $72.9 million available for advance procurement for later ships. We have included in our FY 1971 budget request, $182.8 million to complete the funding of the second ship, which is now estimated to cost $213.8 million. We have also included in our FY 1971 budget request $38.5 million, which together with the $72.9 million available from prior years, will provide a total of $111.4 million for advanced procurement for ships to be started subsequent to FY 1971.

The Navy has completed an "inhouse" contract definition effort on the DLGN-38 and now plans to award a contract for the lead ship to Newport News Shipbuilding and Dry Dock Co. on a sole source basis early in 1970. Two other firms could acquire the capability to build this type of ship, and one or both may wish to bid on the follow-on ships, in which case a competitive award would be possible.

With regard to the missile ship modernization program, you may recall that two of the three DLG conversions included in the original FY 1970 budget were cancelled in our April [budget] amendments to provide some of the funds needed to finance ship-building cost growth during FY 1970. We now have included a total of $150 million in the FY 1971 budget for this program—$116 million for conversion of four ships in FY 1971 (plus $34 million of available prior year funds) and $34 million for advance procurement for the four ships scheduled for FY 1972–73.

Last year $68 million was included in the FY 1970 budget to initiate engineering development of a new ship air defense system now designated Aegis (formerly the Advanced Surface Missile System). The Congress, in the belief that a reorientation of the program was in order, cut this amount to $35 million.

We have now reviewed the requirement for this particular system. There is no question but that the existing ship surface-to-air systems have about reached the limits of their growth potential and that a new, more capable system will be needed for the late 1970s. We agree, however, that this new system should be developed on the most austere basis consistent with the performance of its intended mission. More specifically, we believe the new system should have an improved radar. We do not believe a new missile is required at this time. The existing Standard missile should provide an adequate capability, as well as reduce the development risk and shorten the time to initial operating capability by about two years.

Engineering development has been initiated in FY 1970 with the $35 million provided by the Congress. Another $75 million is included in our FY 1971 budget to continue this effort.

Sonobuoys. Funds are requested in the FY 1971 budget for the procurement of additional sonobuoys, including two advanced types, DIFAR and CASS, and for the continuation of work on more advanced sensors.

Torpedoes. Another very important element of our ASW capability is the availability of modern, fast torpedoes for our ASW aircraft, escorts, and SSNs.

There will be no procurement of the Mark 46, our latest surface ship/air-launched ASW torpedo, in FY 1971. We are, however, requesting funds in FY 1971 for the new Mark 48 submarine-launched torpedo, the development of which has been underway since 1964. There are three versions of this torpedo, the Mark 48-0, which is primarily an ASW weapon; the dual purpose Mark 48-1, which is designed for use against both submarines and surface ships; and the Mark 48-2, which is a dual purpose version of the Mark 48-0.

There is an urgent requirement for both of these capabilities, particularly

the ASW capability. . . .

Accordingly, the Navy plans to complete development, test, and evaluation of all three versions of the Mark 48 torpedo; and then to choose one of the dual purpose versions for the procurement in quantity for the operational inventory. In the interim, the Navy proposes to procure a limited number of Mark 48–0 and Mark 48–1 torpedoes to begin to meet urgent ASW requirements and to keep production lines in-being until evaluation of the Mods 1 and 2 has been completed and the choice made between them, which the Navy now expects will be in mid-1971.

A total of $110.6 million has been included in the FY 1971 budget for procurement of Mark 48–0 and Mark 48–1 torpedoes, and for kits to convert some Mark 48–0s to Mark 48–2s.

Amphibious Assault, Fire Support and Mine Countermeasure Forces

The revised amphibious assault ship force proposed by the previous Administration a year ago would have provided a 20-knot lift for 1-2/3 Marine Expeditionary Forces (MEF), one in the Pacific and two-thirds in the Atlantic. A sufficient number of older, slower ships would have been retained until all the new ships needed to provide this amount of lift had been delivered.

Because of the need to reduce expenditures, the Navy subsequently decided to reduce amphibious lift in FY 1970 to four Marine Expeditionary Brigades (MEBs), which is equivalent to 1-1/3 MEFs—two MEBs in the Pacific and two MEBs in the Atlantic. We now plan to maintain this same lift capability through FY 1971.

Amphibious Assault Ships. Pending a final decision on the longer range force objective, we propose to go ahead in FY 1971 only with the two amphibious assault ships (LHAs) planned last year, plus advance procurement for two more that we may want to start in FY 1972. We are not requesting funds at this time for the seven landing ships tank (LSTs) planned last year for FY 1971.

Last year, the preceding Administration had planned to construct nine multi-purpose amphibious assault ships—one in FY 1969 and two in each of the succeeding four years. On May 1, 1969, the Navy signed a multi-year contract with Ingalls Shipbuilding Division of Litton Systems, with options for a total of nine ships.

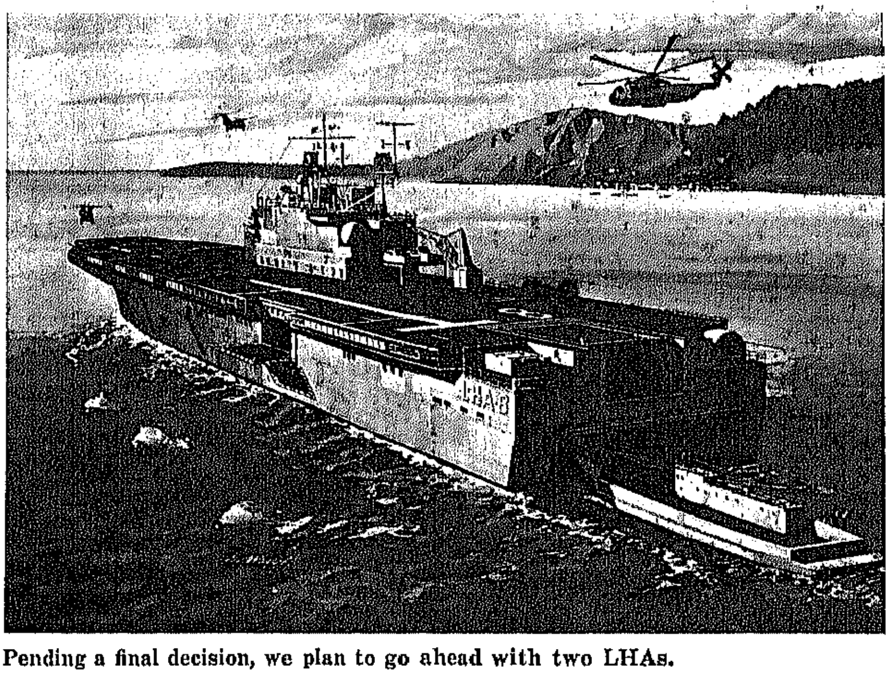
In the last year our cost estimates for this program have been revised in two respects. First, the estimate for construction of nine ships has been raised, from about $1,310 million to about $1,370 million. Second, certain non-recurring costs that were previously charged against the lead ship have, under the terms of the contract, been spread over all nine ships. Thus, the FY 1969 ship is now estimated at $168 million, as compared with $185 million previously estimated, while the two FY 1970 ships are now estimated at a total cost of $312 million, compared with $288 million in the FY 1970 budget. The increase of $7 million in the cost of the first three ships will be provided from presently available funds.

We have included a total $313.5 million in the FY 1971 budget for the LHA—$286 million to complete the funding of two ships and $27.5 million for advance procurement for two more.

Fire Support Ships. The fire support force now includes two 8-inch gun cruisers (CAs), and four rocket-launching ships (LFRs). Two older gun cruisers and a reactivated battleship were retired in FY 1970 as a part of our FY 1970 expenditure reduction effort. The LFRs will commence inactiviation in FY 1970 and complete in FY 1971. The two 8-inch gun cruisers will be retained through FY 1971.

The plan proposed a year ago for the modernization of these forces has also been revised. The funds requested in FY 1970 for contract definition of a new type of landing force support ship (LFS), designed to provide major-caliber gunfire support and neutralization fire for the amphibious assault forces, were denied by the Congress. Accordingly, we are now examining alternative ways to meet this requirement.

Mine Countermeasure Forces. We propose to continue in FY 1971 the program begun in FY 1968 to modernize the 62 existing ocean minesweepers (MSOs). The Navy, however, is encountering some problems with this program, due principally to inadequate design. The estimated cost of these conversions has risen from $4.8 million to $5.2 million per ship, and the FY 1968 ships are now expected to be in the shipyard almost twice as long as originally planned. Furthermore, the Navy has only recently contracted for the FY 1969 ships and does not expect to award a contract for the FY 1970 ships until July 1970.



Pending a final decision, we plan to go ahead with two LHAs.

We have, therefore, decided to reduce the FY 1970 and FY 1971 programs from 10 to 5 ships in each year. The FY 1971 budget includes $22.4 million ($26.0 million less $3.6 million of FY 1969 advance procurement funds) for the conversion of five ships.

Inasmuch as significant advances have been made over the past few years in the utilization of helicopters for mine countermeasures, we have concluded that the new MSOs previously programmed for construction in FY 1971–1973 are no longer needed. We have also decided to drop the new mine countermeasures support ship (MCS) previously programmed for FY 1971. One of the two existing MCSs is being phased out in FY 1970.

Logistic and Support Ships

We now expect to have a total of 210 logistic, support and small patrol vessels at the end of FY 1970, compared with 232 at the end of FY 1969. Some 28 of the oldest and least capable ships are being phased out earlier than previously planned as part of our expenditure reduction effort. During FY 1971, the number is expected to remain at 210 with several new ships now under construction being delivered to the Fleet and some older ships being phased out.

Fiscal constraints, however, have not permitted inclusion of any funds for logistic and support ship construction in FY 1971 budget. Moreover, we have had to cut back prior year construction programs in order to provide some of the funds required to offset claims and cost growth in the shipbuilding program generally. As a result, no new logistic and support ships have been funded since FY 1968. This is one of the programs to which we will have to give special attention in FY 1972, since many of these ships were built in World War II and will soon have to be retired.

Cost Growth in Shipbuilding Program

There is another matter I would like to mention before I leave the shipbuilding program, and that is the problem of cost growth. You may recall that when I appeared before the Congressional Committees in the spring and summer of last year, I noted that we had already identified a deficiency of $600 to $700 million in the FY 1969 and prior year shipbuilding programs. I also noted that we would continue to review the cost growth problem and report to the Congress any additional deficits we might uncover.

Last November, in appearing before the Defense Subcommittee of the House Appropriations Committee, I pointed out that the deficiency in the shipbuilding program had grown to an estimated $800 to $850 million, and that there was a potential for as much as $350 million more. Now, after a detailed review of the entire program, we estimate the identifiable cost growth at $812 million, including the $35 million needed to restore the SSN Guitarro which accidentally sank at the shipyard. The specific amounts involved in the *potential* cost growth problem cannot, of course, be identified at this time, but we still believe it will amount to at least $350 million.

The FY 1970 budget amendments, transmitted to the Congress in April 1969, provided a total of about $350 million ($183 million in FY 1969 and $167 million in FY 1970) to cover the claims and cost growth then expected to mature before the end of FY 1970. The FY 1969 amount was obtained by cancelling three ships funded in FY 1968 and FY 1969, while the FY 1970 amount was to be derived by the cancellation of various ships, aircraft, and other Navy procurement programs proposed in the original FY 1970 budget.

Later in that year, the Navy took action to provide some of the additional funds needed to cover the more recently identified deficiencies which I reported to the Congress in November. The FY 1968–69 program for small craft was reduced by $10 million; a fast combat support ship (AOE) funded in FY 1968 was cancelled, thereby releasing about $84 million; and $10 million was obtained from FY 1967 and FY 1969 funds earmarked for planning and design. Another $48 million was made available in our FY 1971 budget review through a variety of adjustments in prior year shipbuilding programs. These items total $152 million, leaving approximately $310 million as the currently estimated deficiency.

About $100 million of this deficiency does not require funding in FY 1971. We hope that through a vigorous effort to close accounts on the more than 130 ships scheduled to complete construction or conversion in FY 1970–71, we can recover all or part of that amount. Accordingly, we are requesting only $210 million in the FY 1971 budget to finance identified cost growth in the shipbuilding program.

The Navy is well aware that major improvements in the management of the shipbuilding program are urgently needed. Last year, as a result of a comprehensive study of this problem, the Navy developed a new "Shipbuilding and Conversion Improvement Program," which was formally approved by the Chief of Naval Operations on January 15, 1970. The new management program encompasses more than 150 individual improvement tasks identified in Navy studies, inspection reports and other sources during the past year. Its principal features include:

- A documented inventory of improvement tasks.
- The identification of plans, milestones, and resources.
- The establishment of accountability for accomplishment.
- The provision for regular, high level reporting and appraisal.

Some positive improvements in policies, organization and procedures have already been accomplished. For example, the authority and responsibility of the project manager have been clarified and strengthened. He now reports directly to the Commander of the Naval Ships Systems Command, and he has been given full control over all of the funds allocated to his project. He is now also responsible for ship cost estimates and the control of changes. Cost estimating procedures have been revised to ensure that top management is aware of the risks reflected in the estimates.

Major efforts are now underway to improve the timeliness, completeness and soundness of ship specifications, and to bring the concurrency problem under better control. Considerable improvement is still required in these two critical areas, which have contributed so greatly to the cost growth problem in the shipbuilding program.

Mobility Forces

The mobility forces, active and reserve, are designed to provide, together with available commercial air and sealift resources, the lift needed to meet defense requirements in an emergency. The two major problems in this area at the present time are the C–5A program and the adequacy of the sealift immediately available for defense use.

C–5A Program

Last year, in light of the very substantial increases in estimated costs of the C–5A program, the FY 1970 buy was reduced from the 33 aircraft which had previously been planned to 23 aircraft. These 23 aircraft, together with the 58 already on order, will provide a four squadron force. Because of the heavy costs of the C–5A and our current assessment of airlift requirements, we stopped the buy at four squadrons. We believe that these four squadrons of C–5As, together with 14 squadrons of C–141s in the active forces and a Civil Reserve Air Fleet (CRAF) of about 450 four-engine jet aircraft will be sufficient to meet our basic needs for inter-theater airlift movement. . . .

The $623.6 million we have included in the FY 1971 budget relates to the 81 [C–5A] aircraft on order. Of this amount, $200 million has been provided to cover the contingencies which remain in the program. No further procurement beyond the 81 aircraft is proposed.

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Sealift

Although substantial improvements have been made in our rapid deployment airlift capability, we still do not have the total strategic lift needed because of the lack of a rapid deployment sealift capability. Sealift has provided, and will continue to provide, the largest part of our capability for deploying and supporting General Purpose Forces. About 95 percent of the cargo moved to Vietnam has traveled by ship.

There are two major aspects to the sealift problem. One concerns the long-term adequacy of the U.S. Merchant Marine to meet defense and urgent civilian emergency shipping requirements in wartime. The other concerns the availability of sufficient suitable shipping during the crucial early weeks of a major war. The new national maritime program proposed by President Nixon is designed, in part, to solve the first aspect of that problem. I strongly endorse this program; it is particularly important to the mobility planning of the Defense Department, and further details are provided in an appendix. The second aspect of the problem, however, remains unresolved; and because it presents requirements that cannot be met by commercial shipping, this problem must be solved within the context of the DOD program.

The existing DOD-controlled intertheater sealift force is clearly inadequate, both quantitatively and qualitatively, to meet the early lift requirement. Accordingly, some augmentation and modernization of this fleet is essential.

In view of the past reluctance of the Congress to authorize the fast deployment logistic (FDL) ship program, we are looking for alternative solutions. One possibility would be to obtain the specialized rapid deployment sealift capability through the long-term charter of privately owned new multi-purpose cargo ships which would be built according to the design criteria specified by the Military Sea Transportation Service (MSTS).

The new MSTS charter ship would have a cargo capacity of about 46,000 measurement tons. It would be fully capable of quickly loading all military cargo in a ready-to-use condition and its peacetime operations would be continuously controlled so that it could quickly respond to an emergency. We estimate that the average construction cost of the first 10 ships would be about $25 million. Since these multi-purpose cargo ships would be acquired under long-term charter contracts, the construction cost would be amortized over the life of the contract. Based on a 10-year charter period, we estimate the annual cost per vessel would be $5 million—$3.3 million amortization and $1.7 million operating.

MSTS has already selected a final design from the competition conducted in 1968, and has statutory authority to request bids on the basis of an initial five-year charter, plus options for three five-year extensions. However, because of the present money market situation, the initial five-year charter is not proving sufficiently attractive to private investors. To obtain these vessels through a long-term charter program, it will now be necessary for Congress to authorize an initial charter period of 10 years.

Because these ships will be chartered, no government payments will be required until the ships have been delivered and are ready for use.

Appendix E

Mobility Forces

Mobility Forces include: the Military Airlift Command's (MAC) strategic airlift aircraft; the Air Force's tactical airlift aircraft assigned to the Tactical Air Command and unified commands; the transport and tactical airlift aircraft in the reserve components of all the Services; certain cargo and transport aircraft of the Navy and Marine Corps; specialized transportation forces such as aeromedical airlift units and aerial port squadrons; and the troopships, cargo ships, tankers and forward floating depot (FFD) ships operated by the Military Sea Transportation Service

(MSTS). These forces, together with available commercial air and sealift resources, are designed to provide the total lift needed to meet defense requirements in an emergency.

Airlift

The airlift forces currently planned through FY 1971 are shown in a classified table furnished separately to the Committee.

Active Air Force Airlift

On the basis of the current delivery schedule, three C-5A squadrons are expected to be operational by end FY 1971 and all four squadrons by end FY 1972. However, as a hedge against further slippage in the C-5A program, we plan to retain some of the current outsize airlift capability. Three C-133 squadrons will be retained through FY 1970 and two through FY 1971.

The C-141 force reached its programmed strength of 14 squadrons in FY 1968, and we plan to maintain the force at that level.

We propose to continue in FY 1971 the program to modernize the intra-theater aeromedical evacuation force. (Transoceanic aeromedical evacuation is accomplished with C-141 aircraft.) Modernization of the force used within the United States is being completed with 12 C-9s procured in FY 1969. Funds for nine more C-9s are included in the FY 1971 budget to modernize the forces in Europe and in the Pacific. These 21 C-9s will be used to replace 21 C-131 and 19 C-118 propeller aircraft.

We believe the tactical airlift forces programmed for end FY 1971 will provide an adequate capability in the active forces, even though a few C-123 squadrons are scheduled to be transferred to the South Vietnamese Air Force, and one C-7 squadron is being deactivated as a result of cumu- 'o offset this loss of -ability, we are l C-130E squad- procured in FY 16. here were seven ach with 16 unit equipment aircraft) and five C-130B squadrons (four with 16 unit equipment and one with 12 unit equipment aircraft) in the active force. During FY 1970, one 12 unit equipment C-130B squadron is being inactivated to replace attrition losses in the remaining four squadrons, and two C-130A squadrons are being phased into the reserve components. Another C-130B squadron will be inactivated in FY 1971, and 12 C-130Bs will be transferred to the Air Weather Service.

The remaining C-130A and B squadrons will be phased from the active forces to the reserve components during FY 1972 and FY 1973. We plan to use the C-130As to form nine Air Force Reserve and nine Air National Guard units, each with six unit equipment aircraft. The C-130Bs will be used to form three Reserve and three Guard units, each with eight unit equipment aircraft. It may be possible to speed up the phasing of the C-130As and Bs into the reserve components if the situation in Vietnam permits.

In order to provide for a new tactical airlift aircraft in the late 1970s, we have included $2 million in the FY 1971 budget for technology studies and the development of advanced components for a new intra-theater transport.

Air Force Reserve Component Airlift

The Air Force Reserve airlift forces proposed for FY 1970 and for FY 1971 must be considered somewhat tentative pending completion of hearings before the House Armed Services Airlift Subcommittee. However, the FY 1971 budget is based on a planned force of 33 units: 15 C-124, 4 C-130 and 14 C-141 associate units. At end FY 1969, there were 36 Air Force Reserve airlift units: 10 C-119, 19 C-124, 5 C-141 associate and 2 C-130. Most of the C-119 units and some of the C-124 units have already been converted to other airlift aircraft or other missions. Some of the remaining adjustments required to attain the planned end FY 1971 force structure will be postponed, until they have been discussed further with all the appropriate Committees.

The formation of the associate units is progressing well and we remain confident that it is the most effective way to increase our reserve airlift capability. We anticipate forming C-5A associate units in FY 1972 as these aircraft become operational. The associate units, however, with their high level of interdependence between the active and reserve forces are more suited for the Air Force Reserve than the dual command structure of the Air National Guard. We, therefore, plan to have all of the associate units in the former and none in the latter.

Seventeen Air National Guard airlift units—4 C-97, 10 C-124, 2 C-130 and 1 C-123—will be in existence at the end of FY 1970 and will be retained through FY 1971. Nine units, which were formerly equipped with airlift aircraft, have been converted to the following missions during the past few years: four aeromedical airlift, one tactical electronic warfare, two tactical air support groups, and two air refueling groups.

Navy and Marine Corps Airlift

At the end of FY 1970 the fleet tactical support (FTS) category will consist of 82 aircraft, including C-1/ C-2 (carrier-on-board delivery), C-118, C-130, and C-131 aircraft. We plan to buy eight additional C-2 aircraft in FY 1970 to provide an adequate capability to air deliver to carriers on station during periods of peak demand. The FTS force will then contain a total of 90 aircraft, including 45 carrier-on-board delivery aircraft.

The Marine Corps airlift force and the Navy Reserve airlift force are the same as those described last year, a total of 71 aircraft in the former and 77 aircraft in the latter. We plan to retain all of these aircraft.

Sealift

The new National Maritime Program, if approved by the Congress should produce by 1980 a fleet of about 408 general cargo ships, as shown in Figure 8.

This maritime program, if successfully implemented by industry, should eventually provide sufficient seal

augmentation to meet the sustaining support requirements of even the most demanding military contingency for which we are currently planning. In the early to mid-1970s, however, we could still be faced with a shortage of sealift if the pace of new construction does not keep up with the attrition rate for old and obsolete commercial ships. Accordingly, the usable ships in the National Defense Reserve Fleet (NDRF) should be retained until the shipbuilding rate overtakes the block obsolescence of the commercial fleet. As of Jan. 1, 1970, there were 45 usable cargo ships in the NDRF, excluding the 94 ships under the control of the Military Sea Transportation Service. It is planned that virtually all of these vessels will be returned to the Maritime Administration by the end of FY 1970. By the mid-1970s we expect that only about 120 Victory ships (equivalent to about 52 C5–S–75a ships) will still be usable.

While the new maritime program would solve the problem of total sustaining sealift capacity, the defense need for immediately available and suitable shipping precludes our sole reliance on commercial sources, just as we cannot depend solely on the commercial airlift capability of the Civil Reserve Air Fleet. There are three basic reasons why this is so.

First, commercial vessels are operated over worldwide trade routes and assembling them in an emergency consumes valuable time. Even when we have a period of strategic warning prior to the decision to deploy forces, it is not always possible or desirable to call the commercial ships off their routes and hold them in readiness for deployments which may or may not be required.

Second, the trend toward containerships in the commercial trade is resulting in a fleet of specialized ships which are usable for resupply cargo but not for moving the heavy and outsize equipment of combat and combat support units. Army vehicles, aircraft, and weapons, for example, require large and unobstructed cargo compartments for loading. In addition, the equipment of the initial units deployed must be loaded in a manner which provides for immediate use (*e.g.*, no disassembly of major parts) and for unit integrity. For economic reasons, the commercial fleet cannot reasonably be expected to develop the capability to meet these requirements.

Third, the commercial containerships depend upon highly developed port facilities for unloading their cargo. However, the ships we need in the earliest stages of a conflict are the kind which can unload their cargo rapidly with no external assistance, and even where no ports exist.

These military sealift needs stand in contrast to the prevailing trend in the Merchant Marine. Today, containerships comprise about 15 percent of the U.S. commercial general cargo sealift capability, but this figure is expected to increase to about 40 percent by 1975 and 60 percent by 1980.

In summary, we want elements of our General Purpose Forces to be so structured and supported by airlift and sealift as to permit them to be deployed rapidly to Asia or Europe. We will not be prepared to do this unless the Defense Department has a sealift capability which is always under its control, and which can move the outsize equipment of these forces in a ready-to-use condition.

The existing Defense Department-controlled inter-theater sealift force consists of 15 Victory ships, 6 old aircraft ferries and 2 roll-on/roll-off ships, 1 constructed in 1958 and the other in 1966. In addition, we have one new, privately-owned roll-on/roll-off ship, the Admiral Callaghan, on long-term charter, and three FFD Victory ships. This sealift force has very limited capability for rapid deployment. Accordingly, some augmentation and modernization of this fleet is essential. The charter program discussed previously in this statement would provide the required capability.

As in the case of the new cargo ship program, the new tanker program presented to the Congress last year was also delayed because the presently authorized charter period was too short to be attractive to investors. Under this program, nine new tankers would be acquired through long-term charter to replace the 16 T–2 tankers now in the MSTS fleet. (The new tankers, 25,000 tons deadweight and 32-foot draft or less, are needed primarily to provide deliveries to ports which cannot handle the larger tankers.) The ships would be built to MSTS design criteria and operated under MSTS control. As they become available in the FY 1974–76 period, the T–2s would be phased out and the MSTS nucleus fleet tanker force would be reduced from the present level of 25 ships to 10. We now plan to proceed with this program as soon as the proposed legislation is enacted.

One other matter in the sealift area is worthy of note. At the beginning of FY 1970 there were 11 troopships in the MSTS fleet, 3 in full operating status (used primarily for rotation of South Korean troops between South Korea and South Vietnam) and 8 in ready reserve status, manned by skeleton civil service crews. In order to reduce FY 1971 expenditures, the Navy has decided to transfer in FY 1970 the eight ships in ready reserve status to the National Defense Reserve Fleet leaving only the three ships now in operation in the Western Pacific.

Estimate of U.S. Flag General Cargo Ships Under New Maritime Program

	1970	1975	1980
Existing Ships	508	220	187
New Construction Ships	—	104	221
Total Ships	508	324	408
In C5–S–75a Equivalents*	310	296	432

*The C5–S–75a is a cargo ship with about a 25,000 measurement ton capacity, a 21-knot speed and a 7-day loading or unloading capability.

Figure 8.

Research and Development

Research and development is one of the most crucial activities financed in the DOD budget. I believe we can all agree that without an adequate research and development effort, our military forces in the future could find themselves out-maneuvered and out-gunned. Far worse, our nation could find itself without an effective strategic deterrent.

Yet it is very difficult to determine with any degree of confidence what constitutes an adequate research and development effort. One factor contributing to this uncertainty is our inability to project with any reasonable degree of accuracy the technological threat to our national security over the next 10 to 20 years.

There is one thing we do know: we cannot settle for anything short of technological leadership in research and development related to national security. The FY 1971 defense budget request for research, development, test, and evaluation (RDT&E) is intended to meet this objective. It reflects our changing priorities within a constrained budget by reducing the funds for the latter stages of development and by sustaining the technological base required to meet possible future requirements. I regard this RDT&E budget as the minimum with which we can have some confidence of meeting our needs in the future.

Soviet Technological Threat

The most formidable technological threat confronting the United States today is the already large and rapidly growing military-related research and development effort of the Soviet Union. Measured in terms of money expended, the Soviet Union is devoting more effort to military-related research and development than is the United States.

Direct comparisons of Soviet and U.S. Government research and development expenditures are always subject to a possibly substantial margin of error because of our limited information on Soviet budgets, and uncertainties about the real purchasing power of the ruble in relation to the dollar. We currently estimate that, on the best available basis for comparison, the Soviet Union in 1970 will spend \$16 to \$17 billion for defense, space, and atomic energy research and development, and for other space-related activities, compared with U.S. expenditures of about \$13 to \$14 billion.

During the last few years, Soviet expenditures on such research and development and space activities have been increasing at a rate of about 10–13 percent per year, while comparable U.S. expenditures have remained relatively constant, and our actual effort has declined when inflation is taken into account. As a result, the Soviet Union probably has forged ahead of us in terms of the total effort currently being devoted to defense-related research and development. Nevertheless, I believe we still have a technological lead over the Soviet Union because of our greater past expenditures.

What this general trend means for the future security of the United States and the Free World simply cannot be clearly foreseen at this time. Expenditure comparisons alone are only one measure, of course, of the contribution of research and development programs to military capability.

It is very difficult to compare the results of U.S. and Soviet research and development programs. Because the Soviet Union is a closed society, it can and does conduct much of its military research and development programs in secrecy, making it very hard for us to have a timely assessment of its progress. However, once a Soviet system reaches the test and evaluation phase, we can of course obtain valuable information.

As you know, we have been able to observe a number of new Soviet systems which use highly advanced technology and production techniques: the Foxbat aircraft, nuclear-powered ballistic missile submarines, new types of attack submarines, new radars and missiles both for missile and for air defense, anti-ship missiles, new ASW ships equipped for helicopter operations, and smaller items such as the advanced rocket-launcher introduced effectively into Vietnam. The technology of many of these systems is comparable to U.S. technology. In some cases, however, our current systems are clearly more advanced.

Nevertheless, we simply do not know enough about the specific details of the Soviet research and development program inside their laboratories and research institutes to assess fully the entire threat. Under these circumstances, the only course we can prudently follow is to advance our own knowledge at a reasonable pace in every area judged to be important to our future military strength.

This does not mean developing and procuring new systems just because it becomes possible to do so. It does mean that to ensure our future safety, we must invest each year a reasonable amount of resources, not only for development of new military equipment and weapon systems, but also for improvement and expansion of our technological base.

Exactly what specific new weapons and equipment should be developed at any particular time is a difficult but tractable problem. Here, our existing knowledge and understanding of the technological threat offers some useful guidance. For example, it is clear from what we already know about the new Soviet fighter aircraft now being tested, that we will need more capable air-to-air fighter aircraft than we now have, if we wish to ensure our battle-

field air superiority in the late 1970s. We believe that such air superiority is absolutely essential to enable U.S. and allied ground forces to carry out their assigned missions.

How such a new air superiority aircraft should be designed, what performance characteristics it should have, how many we should buy and what they should cost, are all matters which are properly subject to analysis, rational debate, and review within and between the Executive Branch and the Congress.

The management process is not as straightforward, however, in those categories of research and development which constitute our technological base, *i.e.*, research, exploratory development, and some areas of advanced development. (These categories account for about 15 to 20 percent of the total research and development costs.) Here, we are dealing with thousands of individual tasks and projects, each of which is intended to make some significant contribution to the overall base from which we could draw in the later development of a particular piece of hardware.

And, although this supporting technological base is difficult to evaluate and manage, its critical importance to our military strength—5, 10, and 20 years in the future—is obvious. This is precisely the area in which we are most deficient in our knowledge of the Soviet technological threat.

If we fell behind the Soviet Union in the basic areas of research and development, it would be difficult, expensive, and time consuming to catch up. Therefore, the only reasonable course is to press forward in our search for new knowledge at a reasonable pace and in a balanced manner to cover all areas of importance to our future military strength.

Throughout these projects, my own staff carefully reviews the broad areas of technical need, and we do require detailed justifications of the approach taken and the relevance of each effort to military functions. The Military Services carry out more detailed reviews of every project on a continuous basis.

The technological base is managed and funded in terms of a structured set of goals, detailed program objectives, and priorities for funding. We are experimenting now with applying even greater discipline by adapting the Development Concept Papers (DCPs), now in effect for major weapon systems development programs, to broad categories of technology. I believe that this could be a major step forward in better research and development management.

Program Summary

For FY 1971 we are requesting a total of $7,346 million for RDT&E. This is $23 million less than the amount actually appropriated for FY 1970. Considering inflation, this represents about a 5-percent reduction in effort between FY 1970 and FY 1971.

Figure 9 shows the research, development, test and evaluation (RDT&E) request for FY 1971 by research and development categories compared to RDT&E for FY 1965, FY 1969, and FY 1970. From this table you will note that funds for the research, as well as the management and support categories, have been held roughly constant. When one takes into account increases in the general price level and civilian pay raises, real funds for these areas will decline about 5 percent from FY 1970 to FY 1971. This decrease will result in fewer research contracts and in personnel reductions at the field laboratories and test facilities.

The slight increase in exploratory development funding should just about offset the cost of living increases—thus providing essentially a constant level of actual effort in exploratory development, compared with FY 1970.

The advanced and engineering development categories show large increases in funding for FY 1971 compared to FY 1970. The advanced development increases are concentrated in new missile, helicopter and ship programs. The engineering development increases are largely attributable to the F-15, S-3A, A-X, a new ship air-defense system called Aegis (formerly ASMS), and other airborne weapons and equipment; some decreases have been made in Maverick, Army electronic equipment developments, and other programs. These increases in advanced and engineering development reflect our view that we must provide advanced systems to meet critical identified threats.

Financial Summary of Research and Development

(TOA, $ Millions)

	Fiscal Year				
	1965	1968	1969	1970	1971
Research	380	376	414	379	380
Exploratory Development	1,099	934	902	887	982
Advanced Development	744	708	965	940	1,114
Engineering Development	889	840	801	1,022	1,396
Management and Support	1,540	1,500	1,585	1,543	1,512
Emergency Fund				75	50
Sub-Total, Research and Development	4,652	4,358	4,667	4,846	5,384
Operational Systems Development	2,289	3,354	3,489	2,976	2,356
Total Research and Development	6,941	7,707	8,156	7,822	7,740
Less Support from Other Appropriations	502	419	400	333	394
Total Obligational Authority					
RDT&E Appropriations	6,439	7,288	7,756	7,489	7,346
Financing Adjustments	+44	−3	−127	−70	—
New Obligational Authority					
RDT&E Appropriations	6,483	7,285	7,629	7,369	7,346

Figure 9.

The large reduction in operational systems development is primarily the result of the reduced research and development funding for the F-14, Minuteman, F-111, Poseidon, and cancellation of the Manned Orbiting Laboratory program.

To illustrate our concern that we get the maximum results from available research and development funding, I should point out that we have been able to increase some RDT&E programs by about $900 million since FY 1968 through utilizing the funds released by cancellation of some programs and decreases in the special research and developments activities related to Southeast Asia. . . .

Adequacy of FY 1971 Request

It is true that when our FY 1971 RDT&E program request is considered in light of the growing Soviet technological activities, a serious question is raised about the adequacy of that request. In my view, we first must vigorously improve the efficiency of our research and development management in order to make sure that the available resources are used most effectively. Next, during this transition year we must and will carefully assess in conjunction with the Congress whether additional resources for the future will be needed to assure an adequate research and development effort.

We have already instituted major changes in the research and development management procedures of DOD. They are designed to improve our research and development planning, cut costs, and control the system acquisition process. . . .

We hope that improved management will help resolve much of the criticism focused in the past on defense RDT&E. Of course, favorable developments in other areas, including Strategic Arms Limitation Talks, might change the requirements we see today. Pending such developments, however, I hope we can all agree that the RDT&E request before you represents the absolute minimum program needed for FY 1971.

Other Research and Development Issues

The RDT&E efforts for selected Strategic, General Purpose, and Mobility Forces programs are discussed in the sections dealing with those forces. I would like to cover briefly a few other research and development areas.

Independent Research and Development

During the debates on the 1970 Authorization Bill, a number of proposals were made which, if approved, would have inhibited the independent research and development efforts funded by industry. A bill still under consideration by the Senate would prohibit the reimbursement of costs for independent research and development under negotiated contracts, unless such costs have been specifically provided for in the contract and are of direct or indirect benefit to the work performed under that specific contract. I believe that such restrictions would stifle new and imaginative efforts and, thus, effectively reduce the technological effectiveness of our industry. We are continuing an intensive re-examination of this entire matter.

Relationship of Research to "Specific Military Functions"

As you know, Section 203 of the FY 1970 Military Procurement Authorization Act provided that Defense Department research and development funds may not be used for projects unless they have a "direct and apparent relationship to a specific military function or operation." We intend to comply fully with this provision and we are now conducting a detailed review of the entire research and exploratory development categories. As this review proceeds, we will terminate or phase out all efforts that do not fulfill the provisions of Section 203.

I must caution, however, against expecting significant budget reductions because of this review. Most of our programs already fulfill the requirements of Section 203 because of the trend over several years of limitations on the budget available to examine an expanding range of technical opportunities. In this situation, only highly promising technical proposals related to important military needs could be supported. Further, the initial indications are that the budget cuts imposed on the military science activity by Congress in FY 1970 are much greater than the cuts likely to be associated with the Section 203 review. Thus, further cuts are being made even beyond those necessary to implement Section 203.

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Chemical Warfare and Biological Research

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For chemical warfare RDT&E in FY 1971, we are requesting $46.8 million; and for defensive biological research, $21.6 million. However, both of these programs are being further reviewed at my direction (and may be reduced) to design a new RDT&E effort fully reflecting the President's decisions.

Southeast Asia RDT&E (PROVOST) for FY 1971

A continuing Southeast Asia-oriented RDT&E effort is being maintained for three reasons: (1) to support our own transitional forces in Vietnam; (2) to provide for possible post-war application to U.S. General Purpose Forces; and (3) to provide some continuing assistance to our Southeast Asian allies. The research and development funding request for projects oriented to these objectives for FY 1971 is $381 million. . . .

[Editor's Note: A condensation of the statement on the FY 1971 Defense RDT&E Program, by Dr. John S. Foster Jr., Director, Defense Research and Engineering, before the joint Senate Committee, is planned for the May 1970 issue of the *Bulletin*.]

Management in the Defense Department

During the past year, there have been significant changes in Defense Department management. These changes have emanated from both inside and outside the department.

Changes from the Outside

A major impact on Defense Department management was caused by the revitalization and strengthening of the National Security Council (NSC) machinery, which had been dormant for eight years. This ranks as one of the most important changes effected by the Nixon Administration.

The Congressionally-approved National Security Act of 1947, as amended, clearly established this council's responsibility for making recommendations to the President about missions, roles and objectives involving United States national security. As this machinery fell into disuse during the 1960s, the President was deprived of the overall review, analysis, and debate he needed on both foreign and military policy.

Now, with the NSC and its machinery in full operation, the President is better able to make personally the basic decisions affecting our national security. Our reviews and resulting decisions of 1969 evolved within this national security machinery. Under this procedure, we are able to bring all governmental points of view to bear in an orderly manner and to conduct comprehensive investigations of the issues involved, ensuring consideration of all reasonable alternatives.

Many of the studies which the Defense Department does as a participant in the NSC process can be used as bases for our own planning. More important, the Defense Department has the benefit of explicit direction on national defense policy from the President through the NSC.

One of the most significant efforts of the NSC last year was a review of both our strategic and limited war strategies and the forces we plan for both. After a thorough study of these forces, their missions, and their required budgets, the President was able to promulgate clear policies on his strategy for our forces and on the resources required to maintain them. This is the strategy which I have previously discussed.

The second major change emanating from the outside and affecting the Defense Department was the President's establishment of the Defense Program Review Committee (DPRC) last October, which I also discussed earlier. Through this machinery, military, political and economic aspects of strategy and forces are considered together before defense requirements are ranked in the scale of national priorities.

These changes from the outside naturally have required a restructuring of management procedures within the department. I have three major points in mind:

First, formulation of broad national security policy and strategy now can be formally established at the Presidential level through the NSC. This avoids the appearance—and sometimes the fact—of defense domination of broad national security policy.

Second, these national-level mechanisms required new procedures to expedite Defense Department interaction with all proper agencies of the Federal Government on specific issues.

Third, and possibly most important, procedures had to be established to ensure that programs and actions at all levels of the department were responsive to the guidance provided by the President as a result of the deliberations and advice of the NSC and DPRC.

Changes from the Inside

As the Committee knows, the scope of the management problem in the Defense Department is unmatched in all the world. In size and in diversity, it has no peer.

A substantial portion of defense activities falls into fields of rapidly changing technology, increasing the risk that decisions may be wrong or quickly outmoded.

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Despite all the management difficulties, however, effective civilian control of the Defense Department is essential.

We have adopted and are in the process of implementing a concept of management which we believe provides improved efficiency, adequate civilian control and informed decisions. It is based on: participatory decision making, defined decentralization, and delegation of authority under specific guidance.

Ultimately, management of the Defense Department is the responsibility of the Secretary of Defense. I cannot delegate that responsibility, nor do I intend to try. Within the President's guidance, the basic policy decisions—such as the choice of major weapons systems for development and production, the level of our forces, the distribution of forces among missions, the deployment of forces throughout the world, as well as many specific issues of major significance—must be made by [Deputy Secretary of Defense] Packard and me.

These decisions are made, however, with the participation of our colleagues. We encourage full discussion among senior military officers and civilian officials within the department of all major issues. I particularly insist that the views of the Joint Chiefs of Staff and of the Military Departments be given full consideration when decisions are being made that involve their particular expertise and experience.

Except for the major policy decisions, I am striving to decentralize decision making as much as possible. The Military Services and the Joint Chiefs of Staff have a great capability for planning, analyzing and developing military forces. They are the ones who will have to operate and support the forces we field. So, we are placing primary responsibility for detailed force planning on the Joint Chiefs and the Services; and we are delegating to the Military Departments more responsibility to manage development and procurement programs.

When I speak of delegation of decision-making authority, I certainly do not mean a mere abdication of authority by myself and Secretary Packard. Before decision-making power is delegated, we attempt to define the specific levels and types of decisions to be made by subordinate authorities; to identify precisely the persons who will bear the delegated responsibility and authority; to set the limits of time, money, schedule and performance for the delegated authority; and to designate the specific monitoring system to measure performance. We also ensure that adequate, specific policy guidance is issued in each area in which decision-making authority is delegated.

Let me give you a few specific examples of major changes in management procedures.

Revised Planning-Programming-Budgeting System

We have made significant improvements in the Planning-Programming-Budgeting System (PPBS) which we believe will increase its effectiveness. The revised system became operational on January 1 of this year, and the FY 1972 budget will be the first to be formulated under it. The system incorporates two types of guidance issued by the President as a result of the NSC process—one strategic, the other financial.

After strategic objectives have been set by the President, the Joint Chiefs of Staff (JCS) prepare a detailed strategy statement oriented to force planning which is reviewed in my office. I then issue specific strategy guidance, with full participation by and input from the JCS.

The President also issues overall fiscal guidance. I break the overall fiscal guidance down by Military Services and by major mission and support categories. Then, I issue detailed fiscal guidance.

The detailed strategy guidance and the more detailed fiscal guidance are the bases for the JCS and Service force planning. The Services meanwhile prepare a five-year program and budget plan. These are coordinated and integrated through formal procedures specified in the PPB System. These new procedures will help me to approve a budget and a five-year defense plan in a timely manner, based on a thorough study and analysis by the military and civilian staffs.

Let me make clear that neither the President's fiscal guidance nor my more detailed fiscal guidance is irrevocable. Figures provided are not ceilings, but guidance. Both are subject to review should the threat or the relevant technology change significantly or should an error be discovered.

Thus, the PPB System becomes a more important top management tool in both strategic policy and fiscal guidance. The new system also broadens participation in the decisions. Lower echelons thus can contribute to a coordinated result.

Weapons Systems Acquisition

In acquiring major weapon systems, we have clearly defined the division of responsibility that will pertain within the Office of the Secretary of Defense and between my office and the Military Services.

We are also working with the Services to improve their management procedures. We must be assured that the lines of authority within the Service will be clear, direct and uncluttered by staff layering so as to permit effective monitoring while avoiding interference with the individual to whom specific authority is delegated.

Problem of Cost Growth

Because of the serious problem of cost growth in major weapon systems acquisition, we are concentrating strong efforts on this problem.

I have testified previously before Congressional Committees that as of June 30, 1969, the cost of 34 major weapon systems had grown some $16.2 billion in excess of original or baseline estimates reported before.

Reasons for Cost Growth

The largest single cause of cost growth is over-optimism in original cost estimates. Two examples of this are the F–15 and DD–963 programs. The planning estimate of total program costs for the F–15 was about $6 billion when approval was given to commence contract definition in September 1968. Our current estimate for the same number of aircraft based on the contract recently signed with McDonnell-Douglas Corp. is $7.3 billion, resulting in over $1.3 billion cost growth.

The DD–963 planning estimate, adjusted to reflect a 50-ship buy, was about $2.8 billion. Our current estimate is some $4.2 billion, again with over $1.3 billion cost growth.

Both the contractors and the Military Services have the same predispositions toward over-optimism in estimating costs. The competition between programs for limited financial resources is severe within the Services. The competition for weapon systems contracts stimulates wishful thinking about economies that can be made.

In our detailed review of the problems associated with weapons acquisition during 1969, we identified the following factors as major causes of the very serious cost growth that has occurred in past years.

Revision of Estimates. This factor accounts for about half of the total cost growth. In this area the most serious problem is unrealistic and over-optimistic estimates early in the program. In the case of the F–15 which went out on contract this year, the growth mentioned earlier is entirely the result of faulty estimates in the planning stage.

In other programs the development problems were underestimated at the beginning of the hardware development and the cost growth was further increased because production was started before development problems were solved. This is a significant factor in the C–5A, the F–111 and the Mark 48.

The large cost growth due to revision of estimates resulted, at least in part, from deficiencies in management both by the contractor and the Service involved.

The following steps have been taken to reduce this type of cost growth in the future:

- More realistic and accurate estimates of cost early in the program.
- Better risk evaluation of the uncertainties likely to be encountered in development.
- Emphasis on accomplishing milestones of achievement in the development phase rather than meeting a predetermined time schedule.
- Changes to assure a minimum committal to production before development is complete.
- Steps to encourage better management by both the responsible Service and by the contractor. This includes more emphasis on meeting cost objectives rather than on meeting only schedule and performance objectives.

Economic Change. This is a factor of cost growth which is difficult to control, but allowances for inflationary increases in cost will be included in future estimates.

Engineering Change. This type of action, normally initiated by the contractor, generates cost growth, which may be justified if the change results in cost-effective performance improvement. This is another major contributor to cost growth. While the need for some changes is valid, much improvement is possible in controlling changes. This will be accomplished—first, by assuring that we do a more complete job of defining what we really need in a system before entering full-scale development; and second, by vigorous review and determination to eliminate many "nice" or "desirable" features which have in the past crept into these systems. Accordingly, we have established thresholds which limit authority of major program managers to order changes without the specific approval of Secretary Packard or myself.

We are attempting to reduce dependence on paper analysis to validate designs, preferring to rely on hardware demonstration and competitive prototypes where feasible. Because of the complexity of modern weapon systems, the cost of competitive prototype development is prohibitive in many cases. We have tried to adapt the principal advantages of prototyping to current weapons development by testing components and having competitive "fly-offs" wherever possible. We are also studying the possibility of increasing the instances where prototyping is feasible by shifting emphasis somewhat from total systems development to component development. This would have the added advantage of limiting the exposure to technological risks.

We are also focusing on general deficiencies in the amount and quality of test and evaluation on a developmental weapon system before it is committed to production. Much remains to be done to improve test and evaluation.

System Performance Change. This also has been a major factor in cost growth. The improved performance may be worth the increased cost. Often in the past, such changes, initiated either by the Government or the contractor, have not been evaluated in relation to the cost increase which results. More emphasis on cost versus performance should result in better control of this type of cost growth. In fact, there may be cases where a reduction in performance may be justified when evaluated in relationship to cost.

Schedule Changes. These result from changes in funding and also from a reevaluation of requirements. With lower levels of funding which require a stretch out in production, unit costs are bound to increase, and this will continue to be a problem as programs are reoriented.

Another reason for underestimating costs has been the failure to appraise adequately the risks of rushing into production on major programs. The tendency has been to short cut the time and the effort which should have been spent in the advanced development stages, where the risk of major failures should be identified instead of during full-scale development. We have instructed the Military Departments that, during concept formulation, they are to identify and analyze the areas of high technical risk. Where formal risk analysis shows that we are not ready for full-scale development, we will defer system development, thereby cutting the risk for the contractor and reducing the temptation for the Government to make over-optimistic forecasts.

Development Concept Paper

Last year I discussed with you the Development Concept Paper (DCP) and our use of this mechanism to help us make the fundamental decisions on about 80 selected major weapon systems. The DCP contains in a paper of 20 pages or less all the relevant data and options on a given system and the timetable for reviews at various thresholds. No major development can be initiated before an acceptable DCP is prepared.

Let me mention another change in our management that supports the DCP process: the Defense Systems Acquisition Review Council. This council, consisting of the key officials in DOD, reviews each major weapon system at the three most important transition points it its life: conceptual to validation phase, validation to full-scale development phase, and full-scale development to production phase. Its function is to advise me or the Deputy Secretary of Defense of the status and readiness of the program to proceed to the next phase in its life cycle. Starting with the first review in September 1969, 6 reviews have been held to date and about 30

more are scheduled for the remainder of the year.

The 80 major development programs represent only a portion of our total research and development activity for which DCPs are prepared. There are about 2,000 smaller programs and projects. It is clearly not feasible to prepare and review at the Secretary of Defense level a separate DCP on each of the myriad of programs that do exist. Yet, we believe it would be most beneficial to have the advantages of the DCP-type management tool available for the entire spectrum of research and development programs. Accordingly, we are studying the feasibility of designing and utilizing a type of Development Concept Paper for each mission or broad technology area encompassed in our research and development programs. The extension of the DCP approach to these programs is by no means a simple problem, but the potential for improved management justifies diligent and exhaustive effort to make this extension of the DCP concept a reality.

Although the major trend of our management is in the direction of greater delegation of responsibility and authority, the decentralization is selective, not random. In some areas, we find that despite the strong trend in recent years toward centralization in the Defense Department, the management of some critical and high-cost activities is still markedly diffused. In these areas, some centralization is essential to sound management.

* * * * *

Logistics

While the weapon systems acquisition process is an important part of logistics, it is only a part of the total logistics problem of supporting our forces stationed around the world. After contracts are awarded, they must be administered until completed. After equipment is delivered, it must be operated and maintained.

I found when I became Secretary of Defense no adequate management tools in the department to enable top management to evaluate overall logistics performance so that timely corrections could be made.

...Mr. Packard, in March 1969, directed the Assistant Secretary of Defense for Installations and Logistics [Barry Shillito] to develop a system which would permit us to establish realistic objectives, measure progress, evaluate results, and take prompt corrective action when necessary. In the initial program, emphasis was to be placed on 20 to 30 carefully selected key logistic areas, in order to avoid spreading our efforts too thinly.

The new Logistics Performance Measurement and Evaluation System was formally established by DOD directive in May 1969. As of Sept. 30, 1969, some 19 areas were being actively monitored. I would like to illustrate how the new system works by citing two examples, one in contract administration and one in supply management.

A letter contract is perhaps the least desirable contractual arrangement from the government's point of view, since the only effective protection afforded the taxpayer is the limit on expenditures stated in the contract. The work to be performed, the schedule to be met, the price to be paid, etc., are all subject to later negotiations. Consequently, a letter contract should be used only in the most extraordinary circumstances, where time is of the essence. And, even then, a letter contract should be converted to a definitized contract as soon as possible.

At the end of FY 1965, there was a total of $562 million in defense letter contracts outstanding. By the close of FY 1967, under the pressure of the Vietnam buildup, the amount outstanding had grown to almost $5 billion—$3.6 billion of which had been outstanding for more than six months. Even as late as December 1968 some $4.4 billion was outstanding, of which more than $2.9 billion was six months old or older.

This was one of the first areas to be included in the new system. As of the latest reporting date, Sept. 30, 1969, the total amount outstanding had been reduced to about $2.2 billion, and the amount over six months old to less than $1.5 billion. Our goal is to reduce the total outstanding balance to about $2 billion and the amount over six months old to about $1.1 billion by June of this year.

Stock availability was another subject selected for special management attention. One of the first problems we found in this area was that the Navy did not even have the data required to begin with. This deficiency was corrected, but not in time for the Sept. 30, 1969, Status Report.

With regard to the other Military Services, it appears that in FY 1969 the Army was able to meet 75 percent of its demand from stocks on hand, the Marine Corps 60 percent, the Air Force about 69 percent and the Defense Supply Agency about 90 percent.

Ultimately, we hope to raise the Military Services to 85 percent, but we cannot expect them to match Defense Supply Agency, which deals primarily with relatively low-cost and technically simple items. Ultimate goals must be restrained, of course, to preserve flexibility and to avoid an uneconomical increase in stock levels. This restraint will take the form of improved inventory management techniques. Thus, our broader objective in this area is to maximize supply availability while holding our investments in inventories to the lowest feasible levels.

Blue Ribbon Defense Panel

I believe it is evident that we have had some encouraging results from our attack on management problems thus far, but equally evident is the fact that much remains to be done. Where deficient organization and procedures must be improved, both in the resource-management and command areas, undesirable duplications and effort must be eliminated. Information reporting must be refashioned to meet needs, not just curiosity. Indirect costs must be identified, measured, evaluated and reduced everywhere possible.

For the longer-range attack on our organizational and management problems, we are expecting assistance from the study and recommendations of the Blue Ribbon Defense Panel under Chairman Gilbert Fitzhugh, the report of which is due June 30.

* * * * *

Financial Tables Relating to Defense Department Budget FY 1971

Table No. 1

FINANCIAL SUMMARY
(Millions of Dollars)

	FY 1964	FY 1968	FY 1969	FY 1970 Johnson	FY 1970 Current	FY 1971
DOD Program						
Strategic Forces	8,576	7,387	8,581	9,425	7,459	7,947
General Purpose Forces	16,883	31,257	30,657	30,504	27,845	24,731
Intelligence and Communications	4,309	5,487	5,820	6,017	5,552	5,238
Airlift and Sealift	1,078	1,814	1,584	2,039	1,724	1,481
Guard and Reserve Forces	1,784	2,203	2,149	2,800	2,534	2,475
Research and Development	4,923	4,354	4,674	5,485	4,847	5,402
Central Supply and Maintenance	4,515	8,469	9,374	9,456	9,447	8,430
Tng, Medical, Other Gen Pers Activities	6,419	11,860	12,417	12,562	13,005	12,585
Admin and Assoc Activities	1,075	1,259	1,308	1,375	1,494	1,489
Support of Other Nations	1,062	2,385	2,869	3,339	3,128	3,162
Total—Direct Program (TOA)	50,624	76,475	79,432	83,002	77,035	72,941
DOD Component						
Department of the Army	12,275	25,246	26,180	26,331	23,864	21,663
Department of the Navy	14,417	21,103	21,795	24,408	22,799	21,744
Department of the Air Force	19,967	25,200	26,126	26,222	24,274	22,729
Defense Agencies/OSD	1,008	1,503	1,575	1,781	1,738	1,728
Defense-wide	1,858	2,738	3,006	3,475	3,607	4,338
Civil Defense	111	86	61	75	70	74
Military Assistance Program	989	600	689	709	684	664
Total—Direct Program (TOA)	50,624	76,475	79,432	83,002	77,035	72,941
DOD Budget Title						
Military Personnel	12,983	19,961	21,385	21,649	22,491	21,033
Retired Pay	1,211	2,093	2,443	2,735	2,859	3,194
Operation and Maintenance	11,695	20,951	22,285	21,941	21,422	19,512
Procurement	14,997	23,290	23,108	25,124	20,300	18,649
Research, Develop., Test, & Evaluation	7,054	7,290	7,756	8,179	7,439	7,346
Special Foreign Currency Program	—	—	5	4	5	8
Combat Readiness, SVN Forces	—	—	—	—	—	300
Military Construction	983	1,604	1,181	1,951	1,142	1,424
Family Housing	602	600	519	634	624	737
Civil Defense	111	86	61	75	70	74
Military Assistance Program	989	600	689	709	684	664
Total—Direct Program (TOA)	50,624	76,475	79,432	83,002	77,035	72,941
Financing Adjustments	298	−73	−2,903	−2,357	−3,108	−1,690
Budget Authority (NOA)	50,922	76,402	76,529	80,645	73,928	71,251
Outlays	50,786	78,027	78,666	79,000	77,000	71,791

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Table No. 2

CHRONOLOGY OF THE BUDGET—FY 1970 AND FY 1971

(Millions of Dollars)

	FY 1970 Budget					
	Johnson budget	Budget as amended Apr. 15, 1969	Current budget excl. suppl.	Military, civilian and retired pay suppl.	Current budget	FY 1971 budget
Program (TOA)						
Military Personnel	21,649	21,642	20,835	1,656	22,491	21,033
Retired Military Personnel	2,735	2,735	2,735	124	2,859	3,194
Operation & Maintenance	21,941	21,792	20,851	571	21,422	19,512
Procurement	25,124	23,128	20,300	—	20,300	18,649
Research, Dev., Test & Evaluation	8,179	8,227	7,439	—	7,439	7,346
Combat Readiness, SVN Forces	—	—	—	—	—	300
Military Construction	1,951	1,418	1,142	—	1,142	1,424
Family Housing	634	627	624	—	624	737
Civil Defense	75	75	69	1	70	74
Spec. Foreign Curr. Prog.	4	4	5	—	5	8
Subtotal—Military Functions	82,293	79,649	73,999	2,352	76,351	72,276
Military Assistance	709	759	684	—	684	664
Total—TOA	83,002	80,408	74,683	2,352	77,035	72,941
Financing Adjustments	−2,357	−2,820	−3,108	—	−3,108	−1,690
Budget Authority (NOA)	80,645	77,589	71,576	2,352	73,928	71,251
Outlays	79,000	77,893	74,674	2,326	77,000	71,791
Program (TOA) by Component						
Dept. of the Army	26,331	24,967	23,022	842	23,864	21,663
Dept. of the Navy	24,408	23,881	22,109	690	22,799	21,744
Dept. of the Air Force	26,222	25,437	23,652	621	24,274	22,729
Defense Agencies/OSD	1,781	1,771	1,663	74	1,738	1,728
Defense-wide	3,475	3,518	3,483	124	3,607	4,338
Civil Defense	75	75	69	1	70	74
Military Assistance	709	759	684	—	684	664
Total—Department of Defense	83,002	80,408	74,683	2,352	77,035	72,941

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Table No. 3

DIRECT BUDGET PLAN (TOA), BUDGET AUTHORITY (NOA) AND OUTLAYS

Fiscal Years 1969–1971

(Millions of Dollars)

	Direct Budget Plan (TOA)			Budget Authority (NOA)			Outlays		
	FY 1969	FY 1970	FY 1971	FY 1969	FY 1970	FY 1971	FY 1969	FY 1970	FY 1971
Functional Classification									
Military Personnel									
Active Forces	20,487	21,382	19,916	20,494	21,382	19,916	20,482	21,250	19,843
Reserve Forces	897	1,109	1,117	934	1,109	1,117	892	1,051	1,068
Total—Military Personnel	21,385	22,491	21,033	21,427	22,491	21,033	21,374	22,301	20,911
Retired Military Personnel	2,443	2,859	3,194	2,450	2,859	3,194	2,444	2,857	3,193
Operation and Maintenance	22,285	21,422	19,512	22,349	21,422	19,512	22,227	21,500	19,650
Procurement	23,108	20,300	18,649	20,542	17,842	17,357	23,988	21,550	18,799
Research, Development, Test, & Eval.	7,756	7,439	7,346	7,629	7,369	7,346	7,457	7,300	7,382
Combat Readiness, SVN Forces	—	—	300	—	—	300	—	—	105
Military Construction	1,181	1,142	1,424	1,168	959	1,416	1,389	1,124	1,154
Family Housing	519	624	737	512	607	719	572	630	623
Civil Defense	61	70	74	60	70	74	87	75	70
Special Foreign Currency Program	5	5	8	—	—	3	1	2	5
Revolving and Management Funds	—	—	—	—	—	—	−1,535	−700	−544
Offsetting Receipts	—	—	—	−128	−135	−158	−128	−135	−158
Trust Funds	—	—	—	8	7	7	10	8	8
Intragovernmental Transactions	—	—	—	−8	−7	−7	−8	−7	−7
Total—Military Functions	78,743	76,351	72,276	76,010	73,484	70,798	77,877	76,505	71,191
Military Assistance—Gen. Accts.	689	684	664	671	625	622	686	556	664
MAP Offsetting Receipts—Fed. Funds	—	—	—	—	−11	−39	—	−11	−39
MAP Trust Funds	—	—	—	808	850	850	1,062	970	955
MAP Offsetting Rects.—Trust Funds	—	—	—	−959	−1,020	−980	−959	−1,020	−980
Total—Military Assistance	689	684	664	520	444	454	789	495	600
Grand Total—Dept. of Defense	79,432	77,035	72,941	76,529	73,928	71,251	78,666	77,000	71,791
Summary by Component									
Department of the Army	26,180	23,864	21,663	25,042	23,225	20,883	25,035	24,402	21,553
Department of the Navy	21,795	22,799	21,744	20,968	21,751	21,492	22,508	22,389	20,865
Department of the Air Force	26,126	24,274	22,729	25,304	23,162	22,306	25,892	24,676	23,079
Defense Agencies/OSD	1,575	1,738	1,728	1,625	1,689	1,728	1,295	1,460	1,616
Defense-wide	3,006	3,607	4,338	3,010	3,586	4,316	3,060	3,553	4,008
Civil Defense	61	70	74	60	70	74	87	75	70
Military Assistance	689	684	664	520	444	454	789	495	600
Grand Total—Dept. of Defense	79,432	77,035	72,941	76,529	73,928	71,251	78,666	77,000	71,791

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Table No. 4

DIRECT BUDGET PLAN (TOA), BUDGET AUTHORITY, AND OUTLAYS

Fiscal Years 1969–1971 by Functional Classification and Department or Agency

(Millions of Dollars)

	Dept. of Defense—Total			Dept. of the Army			Dept. of the Navy			Dept. of the Air Force			Def. Ags./OSD/ OCD/MAP		
	FY 1969	FY 1970	FY 1971	FY 1969	FY 1970	FY 1971	FY 1969	FY 1970	FY 1971	FY 1969	FY 1970	FY 1971	FY 1969	FY 1970	FY 1971
Military Personnel															
Active Forces	20,487	21,382	19,916	8,410	8,670	7,924	5,990	6,386	5,896	6,087	6,326	6,096	—	—	—
Reserve Forces	897	1,109	1,117	588	720	724	157	193	198	153	196	195	—	—	—
Total—Military Personnel	21,385	22,491	21,033	8,998	9,390	8,647	6,147	6,579	6,095	6,240	6,521	6,291	—	—	—
Retired Military Personnel	2,443	2,859	3,194	—	—	—	—	—	—	—	—	—	2,443	2,859	3,194
Operation and Maintenance	22,285	21,422	19,512	8,249	7,739	6,619	5,819	5,617	5,161	7,118	6,877	6,520	1,099	1,189	1,212
Procurement															
Aircraft	8,008	6,449	6,327	811	471	294	2,414	2,023	2,518	4,783	3,954	3,514	—	—	—
Missiles	3,282	3,203	3,670	888	819	1,087	754	824	1,003	1,640	1,561	1,580	—	—	—
Ships	1,070	2,632	2,579	—	—	—	1,070	2,632	2,579	—	—	—	—	—	—
Tracked Combat Vehicles & Other Weapons	542	359	330	512	304	274	28	47	56	2	8	—	—	—	—
Ordnance, Vehicles & Rel. Equip.	6,603	4,488	3,260	3,309	2,155	1,657	1,545	1,229	720	1,747	1,103	881	2	1	2
Electronics & Communications	1,514	1,147	893	603	315	273	474	386	305	426	429	301	10	17	13
Other Procurement	2,090	2,022	1,590	594	597	352	1,016	926	781	434	431	422	46	69	35
Total Procurement	23,108	20,300	18,649	6,717	4,661	3,937	7,302	8,067	7,963	9,032	7,486	6,699	57	86	50
Research, Development, Test, & Evaluation															
Military Sciences	599	557	585	186	163	176	153	139	142	147	136	135	112	119	132
Aircraft	1,161	1,598	1,624	150	95	110	411	795	694	599	708	820	1	—	—
Missiles	2,518	2,284	2,230	759	853	896	712	459	494	982	907	774	65	65	66
Military Astronautics	1,074	674	481	10	9	11	18	19	29	1,042	642	438	3	3	3
Ships & Small Craft	354	297	379	—	—	1	354	296	378	—	—	—	—	—	—
Ordnance Vehicles & Related Equipment	366	323	321	161	153	153	160	100	89	45	69	78	—	—	—
Other Equipment	1,178	1,106	1,163	361	304	318	245	242	227	321	303	360	251	257	259
Program-wide Management & Support	507	525	514	50	52	52	140	149	145	306	314	305	11	10	12
Emergency Fund	—	75	50	—	—	—	—	—	—	—	—	—	—	75	50
Total—RDT&E	7,756	7,439	7,346	1,678	1,630	1,718	2,192	2,200	2,197	3,443	3,081	2,910	443	529	521
Combat Readiness, SVN Forces	—	—	300	—	—	—	—	—	—	—	—	—	—	—	300
Military Construction	1,181	1,142	1,424	537	443	741	336	336	328	294	309	309	15	54	46
Family Housing	519	624	737	—	—	—	—	—	—	—	—	—	519	624	737
Civil Defense	61	70	74	—	—	—	—	—	—	—	—	—	61	70	74
Special Foreign Currency Program	5	5	8	—	—	—	—	—	—	—	—	—	5	5	8
Total—Military Functions	78,743	76,351	72,276	26,180	23,864	21,663	21,795	22,799	21,744	26,126	24,274	22,729	4,642	5,415	6,140
Military Assistance	689	684	664	—	—	—	—	—	—	—	—	—	689	684	664
TOA Total—Department of Defense	79,432	77,035	72,941	26,180	23,864	21,663	21,795	22,799	21,744	26,126	24,274	22,729	5,331	6,099	6,805
Financing Adjustments	−2,624	−2,792	−1,363	−1,074	−570	−719	−791	−1,011	−215	−794	−1,082	−364	36	−129	−65
Trust Funds & Offsetting Receipts	−280	−315	−327	−64	−68	−61	−36	−38	−38	−29	−29	−59	−151	−181	−169
Budget Authority (NOA)	76,529	73,928	71,251	25,042	23,225	20,883	20,968	21,751	21,492	25,304	23,162	22,306	5,216	5,789	6,571
Outlays	78,666	77,000	71,791	25,035	24,402	21,553	22,508	22,339	20,865	25,892	24,676	23,079	5,231	5,583	6,294

Table No. 5

BUDGET AUTHORITY (NOA) BY FUNCTIONAL TITLE—FY 1964–1971
(Millions of Dollars)

	FY 1964	FY 1965	FY 1966	FY 1967	FY 1968	FY 1969	FY 1970	FY 1971
Functional Classification								
Military Personnel								
Active Forces	11,951	12,507	14,655	17,426	19,100	20,494	21,382	19,916
Reserve Forces	703	750	818	951	923	934	1,109	1,117
Total Military Personnel	12,655	13,257	15,473	18,377	20,023	21,427	22,491	21,033
Retired Military Personnel	1,228	1,399	1,600	1,839	2,095	2,450	2,859	3,194
Operation and Maintenance	11,705	12,603	15,339	19,434	20,950	22,349	21,422	19,512
Procurement								
Aircraft	5,640	5,962	9,354	9,579	9,452	6,475	5,676	6,062
Missiles	3,676	2,615	1,642	2,207	2,493	3,390	3,090	3,620
Ships	2,060	1,905	1,522	1,757	1,301	821	2,490	2,579
Tracked Combat Vehicles and Other Weapons	(a)	243	579	606	654	542	358	330
Ordnance, Vehicles, and Related Equipment	2,028	1,399	4,108	5,213	6,081	5,859	3,634	2,579
Electronics and Communications	1,353	1,039	1,240	1,385	1,432	1,466	930	774
Other Procurement	889	672	1,568	2,125	1,994	1,990	1,663	1,414
Total—Procurement	15,645	13,836	20,013	22,871	23,408	20,542	17,842	17,359
Research, Development, Test and Evaluation	6,984	6,483	6,746	7,172	7,285	7,629	7,369	7,346
Emergency Fund Southeast Asia and Combat Readiness, SVN Forces	—	—	—	—	56	—	—	300
Military Construction	949	1,049	2,566	1,098	1,543	1,168	959	1,416
Family Housing	644	631	666	507	612	512	607	719
Civil Defense	112	105	107	101	86	60	70	74
Special Foreign Currency Program	—	—	—	7	11	—	—	3
Revolving and Management Funds	—	—	(b)	[b] 535	[b] 178	(b)	—	—
Trust Funds and Offsetting Receipts	(c)	(c)	(c)	−134	−157	−128	−134	−158
Total—Military Functions	49,922	49,363	62,510	71,809	76,091	76,010	73,484	70,798
Military Assistance	1,000	1,130	1,023	782	500	671	625	622
MAP Trust Fund and Offsetting Receipts	(c)	(c)	(c)	401	−188	−151	−181	−169
Total—Military Assistance	1,000	1,130	1,023	1,183	312	520	444	454
Total—Department of Defense	50,922	50,493	63,533	72,992	76,402	76,529	73,928	71,251
Component								
Department of the Army	12,513	12,003	17,492	22,876	22,237	25,042	23,225	20,883
Department of the Navy	14,899	14,845	18,486	20,669	21,122	20,968	21,751	21,492
Department of the Air Force	19,446	19,219	22,655	24,193	25,196	25,304	23,162	22,306
Defense Agencies/OSD	1,023	1,100	1,460	1,567	1,632	1,625	1,689	1,728
Defense-wide	1,928	2,091	2,310	2,403	2,818	3,010	3,586	4,316
Civil Defense	112	105	107	101	86	60	70	74
Total—Military Functions	49,922	49,363	62,510	71,809	76,091	76,010	73,484	70,798
Military Assistance	1,000	1,130	1,023	1,183	312	520	444	454
Total—Department of Defense	50,922	50,493	63,533	72,992	76,402	76,529	73,928	71,251

[a] Amount included in entry for "Ordnance, Vehicles and Related Equipment."

[b] Excludes authority in Stock Funds (10 U.S.C. 2210(b)) to incur reimbursable obligations in anticipation of reimbursable orders to be received in subsequent years. Such authority is included in the Budget Document presentation as "New Obligational Authority."

[c] Trust funds and offsetting receipts were not included in departmental budget amounts in these years.

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Table No. 6

OUTLAYS BY FUNCTIONAL TITLE—FY 1964–1971

(Millions of Dollars)

	FY 1964	FY 1965	FY 1966	FY 1967	FY 1968	FY 1969	FY 1970	FY 1971
Functional Classification								
Military Personnel								
Active Forces	12,312	12,662	14,407	17,054	18,988	20,482	21,250	19,843
Reserve Forces	674	725	755	902	871	892	1,051	1,068
Total—Military Personnel	12,986	13,387	15,162	17,956	19,859	21,374	22,301	20,911
Retired Military Personnel	1,209	1,384	1,591	1,830	2,095	2,444	2,857	3,193
Operation and Maintenance	11,932	12,349	14,710	19,000	20,578	22,227	21,500	19,650
Procurement								
Aircraft	6,053	5,200	6,635	8,411	9,462	9,177	7,646	6,609
Missiles	3,577	2,096	2,069	1,930	2,219	2,509	2,919	3,203
Ships	2,078	1,713	1,479	1,398	1,356	1,949	1,900	1,630
Tracked Combat Vehicles and Other Weapons	(a)	268	257	371	587	508	385	353
Ordnance, Vehicles, and Related Equipment	1,597	1,041	1,642	3,881	5,860	6,590	5,603	4,389
Electronics and Communications	1,264	897	983	1,284	1,595	1,409	1,188	986
Other Procurement	782	625	1,273	1,737	2,204	1,846	1,910	1,630
Total—Procurement	15,351	11,839	14,339	19,012	23,283	23,988	21,550	18,799
Research, Development, Test and Evaluation	7,021	6,236	6,259	7,160	7,747	7,457	7,300	7,382
Combat Readiness, SVN Forces	—	—	—	—	—	—	—	105
Military Construction	1,026	1,007	1,334	1,536	1,281	1,389	1,124	1,154
Family Housing	580	619	647	482	495	572	630	623
Civil Defense	107	93	86	100	108	87	75	70
Special Foreign Currency Program	—	—	—	—	2	1	2	5
Revolving and Management Funds	−452	−741	281	512	2,090	−1,535	−700	−544
Trust Funds and Offsetting Receipts [b]	−183	−200	−231	−130	−164	−126	−134	−157
Total—Military Functions	49,577	45,973	54,178	67,457	77,373	77,877	76,505	71,191
Military Assistance	1,485	1,229	968	873	601	686	556	664
MAP Trust Fund and Offsetting Receipts [b]	−276	−104	35	−15	53	103	−61	−64
Total—Military Assistance	1,209	1,125	1,003	858	654	789	495	600
Total—Department of Defense	50,786	47,098	55,181	68,315	78,027	78,666	77,000	71,791
Component								
Department of the Army	12,011	11,552	14,731	20,952	25,223	25,035	24,402	21,553
Department of the Navy	14,466	13,339	15,961	19,246	22,071	22,508	22,339	20,865
Department of the Air Force	20,456	18,146	20,065	22,918	25,734	25,892	24,676	23,079
Defense Agencies/OSD	695	804	1,063	1,893	1,606	1,295	1,460	1,616
Defense-wide	1,842	2,039	2,272	2,348	2,631	3,060	3,553	4,008
Civil Defense	107	93	86	100	108	87	75	70
Total—Military Functions	49,577	45,973	54,178	67,457	77,373	77,877	76,505	71,19
Military Assistance	1,209	1,125	1,003	858	654	789	495	60
Total—Department of Defense	50,786	47,098	55,181	68,315	78,027	78,666	77,000	71,79

[a] Amount included in entry for "Ordnance, Vehicles and Related Equipment."
[b] Trust funds, offsetting receipts, etc., are estimated for fiscal years 1964, 1965 and 1966.

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Table No. 7

MAJOR PROCUREMENT ITEM QUANTITIES

FY 1970 and 1971 Programs

	FY 1970 program	FY 1971 program
Aircraft		
Army	1,001	814
Navy and Marine Corps	348	261
Air Force	586	390
Total	1,935	1,465
Helicopters	1,259	1,009
Fixed wing aircraft	676	456
Total	1,935	1,465
Missiles		
Army	34,382	19,698
Navy and Marine Corps	3,111	3,791
Air Force	1,600	942
Total—Missiles	39,093	24,431
Ships—Navy		
New construction	10	14
Conversions	9	15
Total—Ships	19	29
Tracked combat vehicles		
Army	2,154	1,939
Marine Corps	136	299
Total—Tracked combat vehicles	2,290	2,238

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Table No. 8

MILITARY AND CIVILIAN PERSONNEL

Yearend Number

	FY 1964 actual	FY 1969 actual	FY 1970 (Johnson)	FY 1970 current estimate	FY 1971 estimate
Military Personnel					
Army					
Officers	110,276	172,367	171,711	165,168	150,460
Enlisted	860,315	1,337,047	1,332,546	1,194,177	1,085,003
Military Academy cadets	1,854	2,532	3,643	3,865	4,119
Total—Army	972,445	1,511,946	1,507,900	1,363,210	1,239,582
Navy					
Officers	76,257	84,974	86,419	81,027	76,650
Enlisted	586,037	686,235	680,838	608,435	562,947
Naval Academy midshipmen	4,150	4,435	4,243	4,243	4,243
Aviation Cadets	719	—	—	—	—
Total—Navy	667,163	775,644	771,500	693,705	643,840
Marine Corps					
Officers	16,819	25,698	26,058	24,588	22,982
Enlisted	172,565	284,073	288,442	269,517	218,203
Aviation Cadets	367	—	—	—	—
Total—Marine Corps	189,751	309,771	314,500	294,105	241,185
Air Force					
Officers	133,029	135,185	135,000	130,013	127,778
Enlisted	719,736	722,936	722,049	675,463	651,325
Air Force Academy cadets	2,838	3,941	4,151	4,151	4,417
Aviation cadets	199	—	—	—	—
Total—Air Force	855,802	862,062	861,200	809,627	783,520
Department of Defense—Total					
Officers	336,381	418,224	419,188	400,796	377,870
Enlisted	2,338,653	3,030,291	3,023,875	2,747,592	2,517,478
Academy cadets and midshipmen	8,842	10,908	12,037	12,259	12,779
Aviation cadets	1,285	—	—	—	—
Total—Defense	2,685,161	3,459,423	3,455,100	3,160,647	2,908,127
Civilian Personnel					
Army	[a] 359,943	455,648	469,717	432,954	415,856
Navy	332,678	423,979	415,264	390,899	361,025
Air Force	[a] 305,070	324,379	322,472	309,396	299,372
Defense Agencies/OSD	37,796	71,534	72,099	69,703	68,875
Total—Defense	1,035,487	1,275,540	1,279,552	1,202,952	1,145,128

[a] For comparability with FY 1969–1971, data include National Guard technicians not classified as Federal employees in FY 1964.

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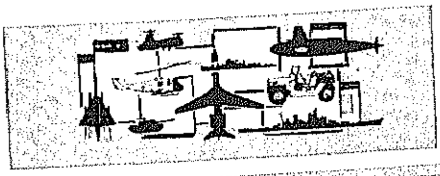

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of February 1970.

DEFENSE SUPPLY AGENCY

3—**Propper International, Inc.**, Mayaguez, P.R. $1,591,696. 1,713,660 hot weather field caps for the Army and Air Force. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1434.

4—**Standard Oil Co. of California**, San Francisco, Calif. $1,272,929. 301,000 barrels of automotive gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-0894.

5—**Putnam Mills Corp.**, New York, N.Y. $1,041,749. 890,384 linear yards of Navy blue cotton and nylon cloth. Marion, N.C., and Westerly, R.I. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1445.

—**Prestex, Inc.**, New York, N.Y. $1,123,861. 1,000,000 linear yards of Navy blue cotton and nylon cloth. Lexington, N.C., Lindale, Ga., and Memphis, Tenn. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1444.

9—**J. H. Rutter Rex Manufacturing Co., Inc.**, New Orleans, La. $1,774,881. 646,410 pairs of men's khaki Army trousers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1462.

13—**Flagg-Utica Co.**, Florence, Ala. $1,153,661. Men's cotton undershirts. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1511.

16—**Ojus Industries Inc.**, Miami, Fla. $1,708,370. 218,020 rolls of concertina barbed tape. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-2552.

17—**Sportwelt Shoe Co.**, Nashua, N.H. $1,761,633. 186,804 pairs of tropical combat boots. Newport, N.H. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1524.

18—**United States Steel International, Inc.**, New York, N.Y. $1,160,272. 1,600,000 six-foot fence posts. Provo, Utah, and subcontractors in Calif. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-D-0010.

27—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for aviation gasoline:

Atlantic Richfield Co., Los Angeles, Calif. $7,592,424. 54,600,000 gallons. DSA 600-70-D-1178.

Atlantic Richfield Co., Chicago, Ill. $8,128,540. 66,700,000 gallons. DSA 600-70-D-1179.

Cities Service Oil Co., New York, N.Y. $7,098,328. 56,363,000 gallons. DSA 600-70-D-1181.

Mobil Oil Corp., New York, N.Y. $20,358,826. 147,982,945 gallons. DSA 600-70-D-1185.

Humble Oil and Refining Co., Houston, Tex. $2,518,752. 16,030,000 gallons. DSA 600-70-D-1184.

Phillips Petroleum Co., Bartlesville, Okla. $7,990,483. 55,637,000 gallons. DSA 600-70-D-1186.

Shell Oil Co., New York, N.Y. $2,260,996. 16,245,000 gallons. DSA 600-70-D-1187.

Union Oil Co. of Calif., Los Angeles, Calif. $1,093,092. 7,644,000 gallons. DSA 600-70-D-1191.

Standard Oil Co. of Calif., San Francisco, Calif. $3,223,924. 23,136,000 gallons. DSA 600-70-D-1188.

—The Defense Fuel Supply Center awarded the following contracts for fuel oil and gasoline (indefinite quantity):

American Oil Co., Chicago, Ill. $1,833,886. DSA 600-70-D-1214.

Atlantic Richfield Co., Philadelphia, Pa. $3,904,966. DSA 600-70-D-1216.

BP Oil Corp., Atlanta, Ga. $3,213,509. DSA 600-70-D-1223.

Texaco Inc., Long Island City, N.Y. $4,215,830. DSA 600-70-D-1260.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

DEPARTMENT OF THE ARMY

2—**Bell Aerospace Co.**, Amarillo, Tex. $2,007,041. Repair of UH-1 crash/damaged aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ-68-D-0056.

—**International Telephone and Telegraph Corp.**, Nutley, N.J. $2,948,501 (contract modification). Repair parts for AN/GRC-143 radio sets. Clifton, N.J. Procurement Division, Army Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0001.

—**Pacific Car and Foundry Co.**, Renton, Wash. $1,987,157 (contract modification). Amphibious cargo carriers, M116A1, and full tracked, amphibious assault vehicles, XM733. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-0029.

—**American Machine and Foundry Co.**, New York, N.Y. $5,611,936. Metal parts for 750-lb. bombs, M117A1E1. Garden City, N.Y. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0279.

—**R. G. LeTournea, Inc.**, Long View, Tex. $6,322,864. Metal parts for 750-lb. bombs, M117A1E1. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0278.

—**Raytheon Co.**, Bedford, Mass. $6,650,000 (contract modification). Advanced development of the SAM-D missile system. Orlando, Fla., Wayland and Bedford, Mass., and White Sands Missile Range, N.M. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1995.

3—**Roy J. Benoit and Sons, Inc.**, Kankakee, Ill. $1,144,000. Construction of TNT area laboratories, lunch rooms, maintenance and change houses, Army Ammunition Plant, Newport, Ind. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0089.

—**General Energy Systems Corp.**, Janesville, Wis. $6,298,000. Erecting acid plants, loading, storage and other support facilities and utilities, Army Ammunition Plant, Newport, Ind. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0038.

—**Frazier-Davis Construction Co.**, St. Louis, Mo. $3,570,208. Construction work, Flood Protection Project, St. Louis, Mo. Army Engineer District, St. Louis, Mo. DA-CW43-70-C-0136.

—**Ammann and Whitney**, New York, N.Y. $1,759,000. Standard design of Perimeter Acquisition Radar and site adaptation for the first Safeguard site, Grand Forks, N.D. Army Corps of Engineers, Huntsville, Ala. DA-CA87-68-C-0011.

4—**Physics International Co.**, San Leandro, Calif. $2,400,000. Construction, installation, integration and activation of a flash X-ray machine and associated subsystems and accessories. San Leandro and White Oak, Md. Defense Atomic Support Agency, Washington, D.C. DA-SA01-70-C-0054.

—**AVCO Corp.**, Charleston, S.C. $4,257,000 Overhaul and/or repair of turbine engines for UH-1H/AH-1G aircraft. Army Aviation Systems Command, St. Louis, Mo DA-AJ01-69-A-0308.

5—**Philco-Ford Corp.**, Newport Beach, Calif $1,229,885 (contract modification). Continued development and improvement o XM140 30mm automatic weapon for air craft systems. Rock Island Arsenal, Roc Island, Ill. DA-AF01-70-C-0102.

—**Bauer Ordnance Co.**, Warren, Mich. $2 139,110. Conversion kit for application c the 20mm weapon system to the M114A reconnaissance vehicle. Army Weapon Command, Rock Island, Ill. DA-AF03-7(C-0052.

6—**AVCO Corp.**, Richmond, Ind. $1,718,79 Metal parts for 40mm high explosive pr jectiles, M406. Army Ammunition Procur ment and Supply Agency, Joliet, Ill. D/ AA09-70-C-0121.

9—**Raytheon Co.**, Andover, Mass. $1,950,37 Improved Hawk conversion test equipme Fort Bliss, Tex., and Andover. Army M sile Command, Huntsville, Ala. DA-AH0 70-C-0768.

—**Institute for Defense Analysis**, Arlingto Va. $1,000,000 (contract modificatio Studies for the Advanced Research Pr ects Agency and the Directorate for I fense Research and Engineering. D HC15-67-C-0011. $1,941,000 (contract m ification). Studies and analyses for D and E, JCS and the Weapons Syst Evaluation Group. DA-HC15-67-C-0012

10—**AVCO Corp.**, Stratford, Conn. $1,735, (contract modification). Continuation design, development and test of the A(1500 gas turbine engine program. A Tank Automotive Command, War Mich. DA-AE07-70-C-0082.

—**Texas Instrument, Inc.**, Dallas, Tex. 000,000 (contract modification). Class electronic equipment. Austin, Tex. A Electronics Command, Fort Monmo N.J.

11—**Brunswick Corp.**, Sugar Grove, Va. 249,485. 2.75 inch rocket launchers, XN Army Missile Command, Huntsville, DA-AH01-69-C-1837.

—**Penguin Industries, Inc.**, Parkesburg, $1,392,202. Fuzes for hand practice nades, XM228. Army Ammunition Pro ment and Supply Agency, Joliet, Ill. AA09-70-C-0268.

12—**General Instrument Corp.**, Hicksville, $2,500,000. Classified electronic equip Army Electronics Command, Fort mouth, N.J.

—The Army Ammunition Procurement Supply Agency, Joliet, Ill., issued th lowing contracts:

Gulf and Western Industries, Waukesha, Wisc. $1,207,611. Metal

for 40mm cartridge assemblies, M384. DA-AA09-70-C-0281. $3,054,100 (contract modification). 40mm cartridge cases, M118, with base plug and cup powder charge. Waukesha and Antigo, Wisc. DA-AA09-70-C-0128.
Harvey Aluminum, Inc., Torrance, Calif. $1,172,500. 40mm cartridge cases, M118. DA-AA09-70-C-0264.
Stewart Warner Corp., Lebanon, Ind. $1,278,000 (contract modification). 60mm high explosive projectiles, M49A3. DA-AA09-70-C-0081.

13—**Norris Industries, Inc.**, Los Angeles, Calif. $1,920,309. Metal parts for 105mm cartridge cases, M14B1. Army Ammunition Plant, Riverside, Calif. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0167.

—**Kaiser Aerospace Electronics, Inc.**, Glendale, Calif. $5,370,488. Gun conversion kits, M139, and repair parts. Army Weapons Command, Rock Island, Ill. DA-AF03-70-C-0054.

—**Collins Radio Co.**, Cedar Rapids, Iowa. $1,165,300 (contract modification). Installation of AN/ARN-83 sets in aircraft. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-69-C-0387.

16—**REDM Corp.**, Wayne, N.J. $1,353,000 (contract modification). Head assemblies for M525 fuzes. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0044.

—**Brunswick Corp.**, Sugar Grove, Va. $1,287,000. White star ground illuminating parachute signals, M127A1. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0411.

—**ITT Gilfillan, Inc.**, Van Nuys, Calif. $1,801,000. Modification kits for AN/FPN-40 and AN/TPX-41. Procurement Division, Army Electronics Command, Fort Monmouth, N.J. DA-AG07-69-C-0846.

—**Martin Marietta Corp.**, Orlando, Fla. $2,139,967. Pershing 1 and 1A missile system under SWAP program. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0806.

17—**Halvorson-Mason**, Portland, Ore. $15,223,980. Completion of the Dalles Power House on the Columbia River, Ore. Army Engineer District, Portland, Ore. DA-CW57-70-C-0078.

24—**Raytheon Co.**, Bedford, Mass. $1,043,000. Repair and modification of AN/MPQ-33 radars to function as doppler velocimeters. Aberdeen Proving Ground, Aberdeen, Md. DA-AD05-70-C-0214.

—**Wilkinson Manufacturing Co.**, Fort Calhoun, Neb. $1,605,000 (contract modification). Fuzes for 81mm projectiles, M524A6. Army Ammunition Supply and Procurement Agency, Joliet, Ill. DA-AA09-70-C-0094.

—**International Harvester Co.**, San Diego, Calif. $2,071,000. Design, development, fabrication and delivery of 22 turbo-alternators (10kw). Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0312.

25—**Remington Arms Co., Inc.**, Bridgeport, Conn. $1,076,750 (contract modification). 5.56mm ball cartridges, M193. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0171.

—**Thomas W. Yoder**, Rockville, Md. $2,445,000. Construction of two additions and alterations to DeWitt Army Hospital, Fort Belvoir, Va. Army Engineer District, Norfolk, Va. DA-CA65-70-C-0066.

—**Winslow Teletronics**, Eatontown, N.J. $1,137,847. Amplifier groups, OA1392/GRC and OA1394/GRC. Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-4413.

—**FMC Corp.**, San Jose, Calif. $1,318,287. Armored personnel carriers, M113A1. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-2600.

—**Seaboard Coastline Railroad Co.**, Jacksonville, Fla. $1,117,975. Hauling and switching services, Sunny Point Military Ocean Terminal, Southport, N.C., March 1, 1970, through Feb. 21, 1971. Eastern Area, Military Traffic Management and Traffic Service, Brooklyn, N.Y. DA-HC21-70-D-0152.

26—**King Hunter, Inc.**, Greensboro, N.C. $1,391,319. Construction of confinement facility, Fort Bragg, N.C. Army Engineer District, Savannah, Ga. DA-CA21-70-C-0084.

—**J. I. Case Co.**, Racine, Wis. $1,642,360. Full tracked tractors, T-5. Burlington, Iowa. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-5160.

—**Stan Flowers Co., Inc.**, Oakland, Calif. $8,150,000. Shipwright carpentry and related services in the San Francisco Bay area, from March 1, 1970, through Feb. 29, 1972. Western Area Military Traffic Management and Terminal Service, Oakland, Calif. DA-HC23-70-D-0048.

—**Goodyear Tire and Rubber Co.**, Akron, Ohio. $2,047,539 (contract modification). Track shoe assemblies for M48-M60 tanks. St. Mary's, Ohio. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-2489.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications:
Scovill Manufacturing Co., Waterbury, Conn. $1,437,930. Loaded grenade fuzes, M219E1. DA-AA09-70-C-0028.
Honeywell, Inc., Hopkins, Minn. $1,264,000. Loaded grenade fuzes, M219E1. St. Louis, Park, Minn. DA-AA09-70-C-0026. $3,766,500. M219E1 grenade fuzes. New Brighton, Minn. DA-AA09-70-C-0027. $1,572,819. Loaded grenade fuzes, XM224. New Brighton, Minn. DA-AA09-70-C-0012.

27—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:
Remington Arms Co., Inc., Bridgeport, Conn. $8,268,212 (contract modification). Operation of facilities, Lake City Ammunition Plant, Independence, Mo. DA-49-010-AMC-00003(A).
Hercules, Inc., Wilmington, Del. $1,987,481 (contract modification). Operation of facilities, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-00037(A).
Uniroyal, Inc., New York, N.Y. $6,188,636 (contract modification). Operation of facilities, Army Ammunition Plant, Joliet, Ill. DA-11-173-AMC-00062(A).
National Gypsum Co., Buffalo, N.Y. $5,410,548 (contract modification). Operation of facilities, Army Ammunition Plant, Parsons, Kan. DA-11-173-AMC-00095(A).
Sperry Rand Corp., New York, N.Y. $0,438,972 (contract modification). Loading, assembling and packing of projectiles, Army Ammunition Plant, Shreveport, La. DA-11-173-AMC-00080(A).
Lakso Metal Products, Inc., West Chester, Pa. $2,934,484 (contract modification). Bomb dispensers, SUU-14A/A. DA-AA00-70-C-0070.
Chamberlain Manufacturing Co., Elmhurst, Ill. $4,218,250. 81mm high explosive projectiles, M374A1. Army Ammunition Plant, Riverbank, Calif. DA-AA09-70-C-0298.
Day and Zimmerman, Inc., Philadelphia, Pa. $14,202,533. Loading, assembling and packing of ammunition, Army Ammunition Plant, Parsons, Kan. DA-AA00-70-C-0245.
Norris Industries, Los Angeles, Calif. $4,136,000. 81mm high explosive projectiles. Army Ammunition Plant, Riverbank, Calif. DA-AA09-70-C-0277.

—**Southwest Truck Body Co.**, St. Louis, Mo. $1,106,484. 36 sets of shop equipment. West Plains, Mo. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-5460.

—**General Motors Corp.**, Indianapolis, Ind. $3,237,319. Installation units, spares and transfer assemblies for XTG-411-2A transmissions for M107, M109, M110 and M578 vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3211.

—**Union Carbide Corp.**, New York, N.Y. $1,817,000. PS116 reserve energizers for M514A1E1 fuzes. Bennington, Vt. Harry Diamond Laboratories, Washington, D.C. DA-AG39-70-C-0039.

—**Oakland Construction Co.**, Salt Lake City, Utah. $5,713,000. Construction of a consolidated field maintenance shop, Fort Carson, Colo. Army Engineer District, Omaha, Neb. DA-CA45-70-C-0049.

—**Olin Corp.**, Stanford, Conn. $7,001,800 (contract modification). Operating facilities, Army Ammunition Plant, Charlestown, Ind. $2,207,587 (contract modification). Operating facilities, Badger Army Ammunition Plant, Baraboo, Wis. DA-AA09-69-C-0148. Army Ammunition Procurement and Supply Agency, Joliet, Ill.

—**Winchester Western Div., Olin Corp.**, East Alton, Ill. $2,189,117. .45 caliber ball cartridges, M1911. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0449.

DEPARTMENT OF THE NAVY

2—**Todd Shipyards Corp.**, New York, N.Y. $12,437,413. Modernization and repair of five minesweepers/minehunters. Brooklyn N.Y. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0240.

—**Sperry Rand Corp.**, St. Paul, Minn. $1,669,255 (contract modification). Computer components and associated spare parts. Naval Ship Systems Command, Washington, D.C. N00024-68-C-1134.

—**Univac Corp.**, St. Paul, Minn. $1,230,014. Development of components for the AN/UYK-7 computer. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1142.

3—**Bendix Corp.**, Teterboro, N.J. $4,648,700. Poseidon components. Naval Strategic Projects Office, Washington, D.C. N00030-70-C-0063.

—**FMC Corp.**, San Jose, Calif. $3,490,836. Engineering field and support services for the Landing Vehicle Track Personnel (LVTP-7 and LVTPX-12) amphibious vehicles. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0250.

—**J. A. Jones Construction Co.**, Nashville, Tenn. $2,247,067. Construction of an 840-man Bachelor Enlisted Quarters building, Naval Air Station, Memphis, Tenn. Naval Facilities Engineering Command, Washington, D.C. N62467-69-C-0201.

4—**General Instrument Corp.**, Chicopee, Mass. $14,381,192. Mk 344 Mod 0 and Mk 376 Mod 0 bomb fuzes. Naval Air Systems Command, Washington, D.C. N00019-70-C-0310.

—**Hughes Aircraft Co.**, Culver City, Calif. $11,850,000 (contract modification). FY 1970 funding for Phoenix missiles. Naval Air Systems Command, Washington, D.C. N00019-67-C-0240.

—**Fairchild Camera and Instrument Corp.**, Copiague, N.Y. $10,067,864. Mk 344 Mod 0 and Mk 376 Mod 0 bomb fuzes. Naval Air Systems Command, Washington, D.C. N00019-70-C-0311.

5—**General Electric Co.**, Schenectady, N.Y. $16,422,000 (contract modification). Design and furnishing of nuclear propulsion components. Naval Ship Systems Command, Washington, D.C. N00024-69-C-5154.

—**Newport News Shipbuilding and Dry Dock Co.**, Newport News, Va. $10,000,000. Long lead time materials and equipment for one nuclear powered guided missile frigate, DLG 38. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0201.

—**Honeywell, Inc.**, Tampa, Fla. $4,527,818. AN/APX-72 radar transponders. Naval Air Systems Command, Washington, D.C. N00019-70-C-0370.

6—**Grumman Aerospace Corp.**, Bethpage, N.Y. $27,200,000. E-2C aircraft. Naval Air Systems Command, Washington, D.C. N00019-68-C-0542.

—**Greenhut Construction Co., Inc.**, Pensacola, Fla. $3,251,249. Construction of an enlisted men's barracks, Naval Construction Battalion Center, Gulfport, Miss. Naval Facilities Engineering Command, Washington, D.C. N62468-70-C-0046.

—**Sperry Gyroscope Co.**, Great Neck, N.Y. $2,045,000. Development program on the Terrier missile radar sets, AN/SPG-55A/B, and ancillary equipment. Naval Ordnance

Systems Command, Washington, D.C. N00017-70-C-2309.

9—General Electric Co., Pittsfield, Mass. $2,718,750. Poseidon Phase IIIB training facilities, project and weapon program coordination. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0108.

10—Algernon Blair, Inc., Montgomery, Ala. $14,801,000. Construction of a 500-bed hospital, Charleston, S.C. Naval Facilities Engineering Command, Washington, D.C. N62467-67-C-0772.

—Lockheed Aircraft Corp., Burbank, Calif. $2,810,929 (contract modification). Increase funding for long lead time effort and material to support FY 70 P-3C procurement. Naval Air Systems Command, Washington, D.C. N00019-69-C-0237.

—Dyson Construction Co., Inc., Pensacola, Fla. $1,636,157. Construction of a controlled humidity warehouse, Naval Construction Battalion Center, Gulfport, Miss. Naval Facilities Engineering Command, Washington, D.C. N62468-70-C-0047.

—Cenco Piping Corp., Janesville, Wis. $1,227,967. Construction of an oceanographic research facility, Naval Air Station, Barbers Point, Oahu, Hawaii. Naval Facilities Engineering Command, Washington, D.C. N62471-69-C-0507.

12—United Aircraft Corp., Stratford, Conn. $1,888,295. Main rotor blades for CH-53A helicopters. Naval Aviation Supply Office, Philadelphia, Pa. N00383-69-A-3900-1320.

—General Electric Co., Utica, N.Y. $1,997,276. Guidance and control groups, Mk 28 Mod 1, for the Army's Chaparral missile. Naval Air Systems Command, Washington, D.C. N00019-70-C-0088.

13—Hughes Aircraft Co., Fullerton, Calif. $11,701,251. Navy Tactical Data System display consoles and supporting equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1216.

—Magnavox Research Labs, Torrance, Calif. $3,203,000. AN/PRR-14 receivers and associated items for the Navy, Army and Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-0220.

—Robert R. Marquis Inc., Portsmouth, Va. $1,626,453. Construction of a dispensary and dental clinic, Naval Amphibious Base, Little Creek, Va. Naval Facilities Engineering Command, Washington, D.C. N62470-69-C-0752.

16—Sperry Gyroscope Co., Great Neck, N.Y. $2,450,000. Refurbishment and conversion of Terrier fire control system, Mk 76 Mods 3 and 5. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2308.

—United Aircraft Corp., Hartford, Conn. $106,678,039. J-52-P-408 and -8A, and TF-30-P-412 and -100 aircraft engines for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-0208.

17—Lockheed Aircraft Corp., Sunnyvale, Calif. $2,160,000 (contract modification). Repair parts for Polaris equipment. N00030-67-0177. $5,380,500. Support, test and readiness equipment and liners for Poseidon missiles. N00030-70-0076. Naval Strategic Systems Project Office, Washington, D.C.

—Hughes Aircraft Co., Culver City, Calif. $20,826,000 (contract modification). AN/AWG-9 airborne missile control systems. Tucson, Ariz., and Canoga Park, Culver City, Los Angeles and El Segundo, Calif. Naval Air Systems Command, Washington, D.C. N00019-70-C-0207.

—Baugh and Coody, Inc., Albany, Ga. $1,144,600. Bachelor Officers' Quarters, Naval Supply Corps School, Athens, Ga. Naval Facilities Engineering Command, Charleston, S.C. N62467-68-C-0198.

18—Ruscon Construction Co., Charleston, S.C. $1,091,194. Construction of Bachelor Officers' Quarters and mess addition, Naval Station, Charleston, S.C. Naval Facilities Engineering Command, Washington, D.C. N62467-68-C-0231.

—The Naval Air Systems Command, Wash- ... 'he following con-

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lead time components to support update of Standard ARM, AGM-78, missiles for the Air Force. N00019-69-C-0336.

Hughes Aircraft Co., Culver City, Calif. $1,000,000. F-14 armament system development and evaluation testing. N00019-70-C-0343.

19—General Dynamics Corp., Groton, Conn. $10,397,000. Advance planning, design work, and long lead-time material procurement preparatory to the overhaul and C-3 conversion of the USS Benjamin Franklin (SSBN 640) and USS Kamehameha (SSBN 642). Naval Ship Systems Command, Washington, D.C. N00024-70-C-0242.

20—Magnavox Co., Fort Wayne, Ind. $2,830,393. AN/SSQ-41A sonobuoys and refurbishing kits. Naval Air Systems Command, Washington, D.C. N00019-70-C-0411.

—United Aircraft Corp., East Hartford, Conn. $4,200,000. Development of the TF-30-P-412 engine for F-14 A aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0393.

—Grumman Aerospace Corp., Bethpage, N.Y. $1,500,000 (contract modification). Long lead-time for A-6 series aircraft. Naval Air Systems Command, Washington, D.C. N00019-68-C-0106.

—Johns Hopkins University, Silver Spring, Md. $3,797,000. Advanced research on the Surface Missile System Program. Naval Ordnance Systems Command, Washington, D.C. NOw 62-0604.

—Westinghouse Electric Corp., Baltimore, Md. $3,800,000. Engineering support for the design, test and evaluation of proposed modifications to the Mk 48 Mod 0 torpedo and Mk 27 Mod 0 mobile target production design. Lansdowne, Md. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1209.

24—Westinghouse Electric Corp., Washington, D.C. $13,153,253. Launcher equipment for Poseidon missiles. Sunnyvale, Calif. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0099.

—Hoffman Electronics Corp., El Monte, Calif. $7,063,887. AN/ARN-84 Tacan navigation system. Naval Air Systems Command, Washington, D.C. N00019-70-C-0326.

—Thiokol Chemical Corp., Elkton, Md. $2,052,000. Mk 67 Mod 0 rocket motors for the ZAP missile. Naval Ordnance Laboratory, White Oak, Md. N60921-70-C-0175.

26—Raytheon Co., Bedford, Mass. $2,552,363. Engineering services and test program support for Sparrow missile interface and integration for F-14A aircraft. Naval Air Systems Command, Washington, D.C. N00019-70-C-0268.

—Grumman Aerospace Corp., Bethpage, N.Y. $23,800,000 (contract modification). Long lead time effort and material to support the FY 1970 EA-6B aircraft program. Naval Air Systems Command, Washington, D.C. N00019-67-C-0078.

DEPARTMENT OF THE AIR FORCE

2—Martin Marietta Corp., Orlando, Fla. $1,061,800. Component parts for munitions. Armament Development Test Center, Eglin AFB, Fla. F08635-70-C-0213.

—United Aircraft Corp., Hartford, Conn. $1,000,000. Aerospace ground equipment for TF-30 aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. N383-69000A-SC51.

—RCS Corp., Burlington, Mass. $1,831,881. Automated test system, data, spare parts and maintenance service, for jet engine accessories applicable to J-79 aircraft engines. Detroit, Mich., Oklahoma City, Okla., and Burlington. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-70-C-6425.

3—General Electric Co., West Lynn, Mass. $6,000,000. Component improvement program for T-58 and J-85 aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0545.

—McDonnell Douglas Corp., Tulsa, Okla. $1,294,833. Maintenance of Air Force Plant No. 3, Tulsa. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF 3(657)16416.

4—Control Data Corp., Minneapolis, Minn. $1,529,121. Rental and maintenance on automatic data processing equipment at Patrick AFB and Cape Kennedy AFS, Fla. Air Force Eastern Test Range, AFSC, Patrick AFB, Fla. F08650-70-M-F189.

5—RCA, Moorestown, N.J. $2,396,332 (contract modification). Operation of radar tracking facilities. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-69-C-0186.

6—North American Rockwell Corp., Anaheim, Calif. $11,194,600. Spare parts for Minuteman III guidance and control systems. Space and Missile Systems Organization, Los Angeles, Calif. F04701-69-C-0194.

9—Westinghouse Electric Corp., Baltimore, Md. $1,875,000. Electronic ground equip ment. Space and Missile Systems Organi zation, AFSC, Los Angeles, Calif F04701 70-C-0062.

10—The Boeing Co., Seattle, Wash. $7,156,761 Design, development and testing of th trajectory perdiction systems and relate equipment for Minuteman III, Space an Missile Systems Organizatin, AFSC, L Angeles, Calif. AF04(694)-791.

—North American Rockwell Corp., Anaheir Calif. $3,011,400. Guidance and contr systems for Minuteman III. Space a Missile Systems Organization, AFSC, L Angeles, Calif. F04701-67-C-0194.

12—General Electric Co., Philadelphia, P $5,969,356. Research and development the Mark 12 reentry vehicle. Space a Missile Systems Organization, AFSC, L Angeles, Calif. AF04(694)-473.

—General Dynamics Corp., Fort Worth, T $1,346,054. Spare parts for F-111 aircra Sacramento Air Materiel Area, AF McClellan AFB, Calif. AF33(657)-1340

13—Control Data Corp., Minneapolis, Mi $1,700,000. Lease of automatic data pr essing equipment at Eglin AFB, F Director for Base Procurement, Arman Development and Test Center, Eglin A Fla. F08651-70-M-8809.

16—Brooks and Perkins, Inc., Detroit, M $2,211,357. Large cargo pallets adaj for mechanized loading of air cargo. C lac, Mich. Warner Robins Air Mate Area, AFLC, Robins AFB, Ga. F09 70-C-2027.

—Lockheed Aircraft Corp., Marietta, $3,619,160. Spare parts for C-5A airc Detachment 31, San Antonio Air Mat Area, Marietta, Ga. AF (657) 15053.

—Goodyear Aerospace Corp., Akron, ($4,172,500. Ground environmental sy used in processing reconnaissance air data. Aeronautical Systems Divi AFSC, Wright-Patterson AFB, (F33657-70-C-0610.

17—AVCO Corp., Greenwich, Conn. $7,60 Ballistic missile penetration aids. S ford, Conn. Space and Missile System ganization, AFSC, Los Angeles, (F04701-68-C-0039.

—Bendix Corp., Teterboro, N.J. $1,28 Modification of B-52 aircraft. Okla City Air Materiel Area, AFLC, T AFB, Okla. F34601-69-C-2685.

18—Philco-Ford Corp., Palo Alto, Calif. 133,059. Logistic support managemer the satellite control facility. Air Satellite Control Facility, Los An Calif. F04701-70-C-0006.

—General Dynamics Corp., Fort Worth $3,000,000. F-111 aircraft. Aerona Systems Division, AFSC, Wright-Pa AFB, Ohio. AF33(657)13403.

19—Teletype Corp., Skokie, Ill. $1,5 Modification kits for converting

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28 teletypewriters from high frequency to low frequency. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-2095.

20—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

Aerojet-General Corp., Sacramento, Calif. $1,600,000. Spare parts for Titan III-C space booster. F04695-67-C-0096.

Lockheed Aircraft Corp., Sunnyvale, Calif. $1,841,000. Research and development on the Air Force Satellite Control Facility. F04701-70-C-0068.

24—General Dynamics Corp., Fort Worth, Tex. $1,776,000. Spare parts for F-111 aircraft. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. AF 33(657)-13403.

—Fairchild Hiller Corp., St. Augustine, Fla. $1,574,000. Modification and reconditioning of C-119 aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-1908.

26—General Electric Co., West Lynn, Mass. $1,422,800. Spare parts for J-85 turbojet engines. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F43601-69-D-2254.

—The Boeing Co., Seattle, Wash. $2,559,122. Spare parts for Minuteman missiles. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F04701-68-C-0165.

27—TRW, Inc., Redondo Beach, Calif. $2,559,600. Services and data for integration, assembly and checkout of the Tactical Air Control System. Electronic Systems Division, AFSC, Wright-Patterson AFB, Ohio. F19628-70-C-0052.

—Northrop Corp., Hawthorne, Calif. $2,000,000. Preproduction planning and long lead time items toward procurement of F-5 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0762.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

General Electric Co., Philadelphia, Pa. $4,215,634. Research and development of the Mk 12 reentry vehicle. AF04(694)-916.

Philco-Ford Corp., Palo Alto, Calif. $1,400,000. Engineering support for the Air Force Satellite Control Facility Network. F04701-70-C-0029.

OFFSHORE

18—Canadian Commercial Corp., Ottawa, Ontario, Canada. $1,789,320. AN/SSQ-41 sonobuoys. Dartmouth, Nova Scotia. Naval Air Systems Command, Washington, D.C. N00019-70-C-0412.

New Single-Sideband Radio Proposed

To enhance communications over greater distance in tactical air-ground operations, the Army Combat Developments Command, Fort Belvoir, Va., has proposed the design of a new single sideband medium/high frequency (SSB M/HF) radio. It would be used in Army aircraft and provide continuous non-line-of-sight tactical communications. It should be compatible with radio sets in tactical Army units on the ground at ranges up to 150 miles, particularly when the aircraft is operating at low altitudes. SSB M/HF should also be operationally compatible with high-frequency SSB equipment using same frequency ranges of the Navy, Air Force, Marine Corps, and the Federal Aviation Agency.

The new radio will be constructed on the modular principle, *i.e.*, printed circuits readily removable for maintenance purposes and marked for positive identification. These maintenance characteristics will permit personnel with rudimentary training to isolate faults and replace modules or major components.

SSB M/HF radios should be sufficiently rugged to withstand the environment, handling and operational conditions of military field use including vibration encountered in helicopters. The equipment will be designed to provide a minimum operating life of 5,000 hours with reasonable replacement of parts, not to include major repair.

Inflated Shelters Tested by Air Force

Air inflatable shelters for use as Tactical Air Control Centers and Direct Air Support Centers are being investigated for the Air Force by the Air Force Systems Command's Electronic Systems Division, L. G. Hanscom Field, Mass.

The air inflatables are an effort to provide the Air Force with "instant" response to combat situations, through the development of modular operations and support centers. Part of the 407L Tactical Air Control Center, the units are transportable by helicopter, fixed-wing cargo aircraft, or truck.

Each center consists of a standardized shelter module, approximately 7-by-13-by-7½ feet, with an expandable hinged side panel providing an additional 15-by-12½ feet of floor space. All communications equipment, display boards, tables and chairs are carried inside the shelter module.

Produced by the Hughes Aircraft Co., Fullerton, Calif., the units have been tested under temperature extremes of —65 and 160 degrees F., winds of 100 knots, and rainfall of 1½ inches per hour. Additional testing is being conducted at Eglin AFB, Fla.

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FY 1971 Modified Phase II Safeguard Program

Supplementing his Feb. 20, 1970, statement on the FY 1971 budget and program (condensed in this issue of the *Bulletin*), Secretary of Defense Melvin R. Laird, on Feb. 24, 1970, released a statement regarding the need for additional Safeguard deployment. In this statement, he outlined specifics on the proposed FY 1971 modified phase II Safeguard program:

For FY 1971, authorization is requested to deploy *one* additional Safeguard site at Whiteman AFB, Mo. (in the Minuteman field). The request also recommends that the FY 1971 program include the deployment of additional Sprint missiles at Grand Forks AFB, N.D., and Malmstrom AFB, Mont. This would raise the number of Sprints at these sites to the phase II level, thus further increasing the total number of interceptors capable of defending Minuteman ICBMs. This will require additional acquisition of small parcels of land and additional silo contruction at Grand Forks and Malmstrom. With regard to the additional Sprint missiles, since the purchase of only the long lead-time missile components is required in FY 1971, the decision to produce and deploy them can be reviewed at a later time.

Authorization for FY 1971 is recommended to undertake a long lead-time task of advanced preparation work for five more sites. This task includes site survey and engineering, land acquisition and purchase of some long lead-time items, but does *not* commit DOD to deployment of radars or missiles. The five sites are Northeast, Northwest, the National Capital Area, Warren AFB, Wyo., and Michigan/Ohio.

The proposed FY 1971 program maintains the President's options to move further toward a 12-site full phase II Safeguard system, if necessary, or to curtail the deployment if threat developments permit. Should it be required, the full 12-site deployment could be installed by the late 1970s if there were FY 1972 authorization for the remaining nine sites, including the five sites for which only advanced preparation authority is requested in FY 1971. The 12-site deployment would provide substantial area defense of the U.S. population for a number of years against Communist Chinese and Nth country attack, and defense adequate to permit most of the U.S. alert bomber force to take off even if attacked by depressed trajectory submarine-launched ballistic missiles. Defense against an accidental launch from any source also would be provided by the 12-site deployment.

The DOD budget submission for FY 1971 includes an authorization request for $1.49 billion for Safeguard. This amount is requested to continue approved phase I deployment, deployment of additional Sprints at phase I sites, commencement of deployment at one additional site, and undertaking advanced preparations at the five potential future sites. Funds for the modified phase II portion of the program would be less than $100 million. Total FY 1971 spending for the Congressionally approved phase I and the proposed modified phase II program will amount to approximately $920 million.

Given President Nixon's determination to postpone additional actions on U.S. offensive systems this year in order to advance prospects for success in the Strategic Arms Limitation Talks, further progress on Safeguard deployment becomes the only viable course available in FY 1971. As the President noted, "Each phase of the deployment will be reviewed to insure that we are doing as much as necessary but not more than that required by the threat existing at that time." The modified phase II deployment recommended for FY 1971 is the minimum that can and must be done, both in cost and in system development, to fulfill the President's national security objectives.

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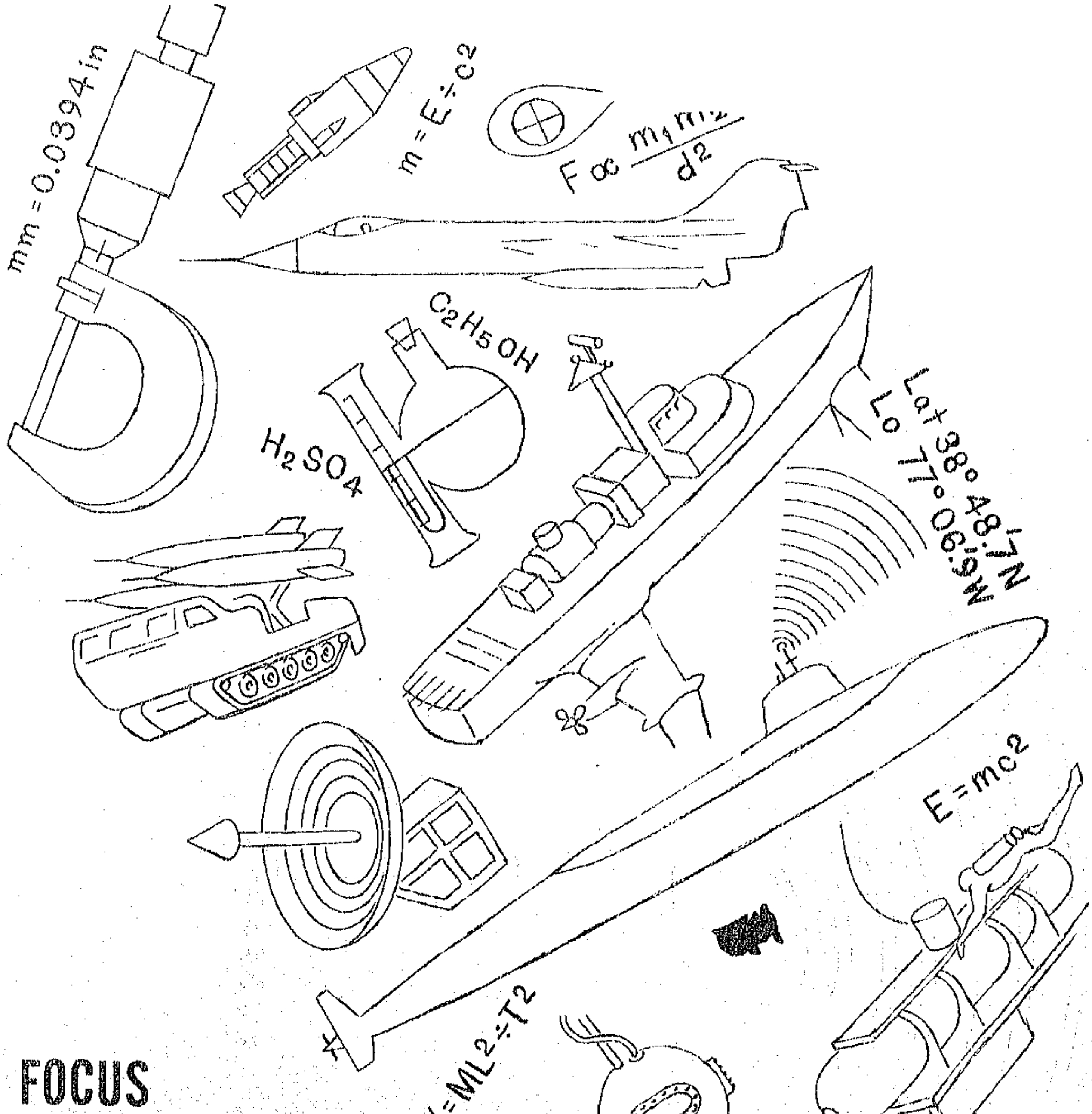

FOCUS ON RESEARCH

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DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 5 May 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

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IN THIS ISSUE

FEATURES

DEPARTMENTS

PPBS in Defense for the Seventies

Laurence E. Olewine

Less than a year ago, the *Defense Industry Bulletin* published an article on the Defense Department's Planning-Programming-Budgeting System (PPBS). The final paragraph of this article stated, "A decision-making process cannot be set in concrete. It must remain dynamic and susceptible to change if it is to retain its utility."

This statement not only rings with truth, but is documented with the considerable modifications to DOD's current PPB operations. Significant changes in this vital facet of the DOD decision process provide the basis for a second article within a year.

(See article, "Defense PPBS—A 1969 Overview," by Commander Steven Lazarus, *Defense Industry Bulletin*, June 1969, page 19.)

Sometimes it is difficult to find specific evidence of change when a firm hangs out the UNDER NEW MANAGEMENT shingle. Such is certainly not the case in the Defense Department, where Secretary of Defense Melvin Laird and Deputy Secretary David Packard have made major revisions in the Planning-Programming-Budgeting System (PPBS).

To trace the evolution of these changes, we must go back to a Secretary of Defense Management Conference held in May 1969. This two-day meeting, attended by the Presidential appointees within the department, was aimed at improving DOD's top-level decision-making process. As a result of discussions at this meeting, basic principles were established for major revisions to the PPB System. A few months earlier, a Pentagon staff effort had also been launched to simplify PPBS procedures. The meshing of these actions resulted in a restyling of the Defense Department's PPB System. The modifications, accepted by all DOD components (military services and defense agencies), are reflected in an Oct. 29, 1969, revision to DOD Instruction 7045.7, "The Planning, Programming and Budgeting System," which is being used as the procedural basis for preparation of the FY 1972–76 defense program and the FY 1972 budget.

This article will not discuss details of the revised PPB System, but will focus on major changes. Emphasis will be on the four new documents that have been added to the cycle. It must be stated at the outset, however, that the Five Year Defense Program (FYDP) is still the heart of the Defense Department PPB System.

One of the key changes is provision for increased input from and consultation with the National Security Council (NSC). The relationship between the Defense Department PPB System and the NSC policy review process is much closer than it has been in recent years. Results of this relationship will be seen in a number of ways in the revised system.

For instance, after forwarding the Joint Strategic Objectives Plan, Volume I, (JSOP I), the strategy and objectives portion of this plan, to the Secretary of Defense, the Joint Chiefs of Staff (JCS) revised it in order to include full impact of the President's recent strategy decisions. These decisions were based on an NSC review of alternative worldwide strategies, forces and budgets. The final version of JSOP I (published in December 1969) provides a more valid basis for planning and programming than did previous JSOPs. There is no question that JSOP I will exert more influence than its recent predecessors.

Strategy Guidance Memorandum

The initial new document in the revised PPB System is based on a review of JSOP I by the Office of the Secretary of Defense. As a result of this review, the Secretary of Defense prepares a *tentative* Strategy Guidance Memorandum. This memoran-

dum incorporates much of JSOP I, and reflects any modifications or additional strategy guidance deemed necessary by the Secretary of Defense.

The tentative Strategy Guidance Memorandum is then sent to the Joint Chiefs of Staff for review and comment. After considering JCS comments,[1] the Secretary of Defense issues a revised Strategy Guidance Memorandum to JCS, the military departments, and the defense agencies early in January. Since the memorandum and JSOP I provide the basis for force planning, the goal of the issuance is current and completely coordinated strategy guidance for the entire defense community.

Fiscal Guidance Memorandum

The second new document is the Fiscal Guidance Memorandum issued by the Secretary of Defense. The memorandum represents a major departure from the previous PPB System. The fiscal guidance indicates overall dollar constraints within which programs are to be developed. The Secretary of Defense issues *tentative* fiscal guidance in January for review and comment by the Joint Chiefs of Staff, military departments and defense agencies. The Fiscal Guidance Memorandum for FY 1972–76 was issued in March.

Based on anticipated DOD dollar resources, the Fiscal Guidance Memorandum projects allocation of funds five years into the future by major mission and support categories for each of the military departments and defense agencies. In preparing the fiscal guidance, consideration will be given to JSOP I, the Strategy Guidance Memorandum, and the current Five Year Defense Program.

To ensure a balanced DOD program, the FY 1972–76 Fiscal Guidance Memorandum indicates that both the Joint Force Memorandum and the Program Objective Memoranda (which are discussed later in this article) must contain a base program with funding levels matching those specified in the fiscal guidance, by military service and by year, for each of the following categories:

- Strategic Forces.
- General Purpose Forces (the *total* of land, tactical air, naval and mobility forces).
- Research and Development (FYDP Program 6).
- Intelligence and Security.
- Support to Other Nations.

To provide flexibility, DOD components may propose alternative force structures based on reallocations among the aforementioned categories by means of annexes to the Joint Force Memorandum and Program Objective Memoranda, as long as military service totals by year remain unchanged.

Introducing fiscal constraints near the beginning of the annual PPB cycle provides a basic change at the very roots of the system. Taking account of the limits on funds early in the cycle forces consideration of alternatives and priorities throughout the entire process by everyone concerned. The constraints of fiscal reality will generate more efficient analysis and evaluation at every step of the process.

During the period when tentative fiscal guidance is being reviewed by the military departments and defense agencies, the Joint Chiefs of Staff are completing JSOP II, the force structure portion (Volume II) of the Joint Strategic Objectives Plan. JSOP II provides recommendations, as well as the associated rationale, on forces needed to meet the strategy guidance. It is significant to note that as in previous PPB cycles, JSOP II is prepared without regard to specific financial constraints.

Joint Force Memorandum

Publication of JSOP II and the Secretary's Fiscal Guidance Memorandum in February and March, respectively, sets the stage for the third new document in the revised PPB System, the JCS Joint Force Memorandum.

This document, issued in April, is indicative of the revised role of the Joint Chiefs of Staff in the PPB cycle. The Joint Force Memorandum again presents force level and support program proposals in a format similar to JSOP II, but JCS recommendations will have been reworked to reflect fiscal constraints of the Fiscal Guidance Memorandum. Where funds delineated in the Fiscal Guidance Memorandum are not adequate to support all of the JSOP II recommendations, the Joint Force Memorandum will contain the JCS assessment of risks associated with reducing the JSOP II recommended forces to meet fiscal constraints. This assessment of risk will be made in light of the strategy and objectives of JSOP I and the Strategy Guidance Memorandum. The Joint Force Memorandum will also highlight major force issues to be resolved during the year. Copies of the Joint Force Memorandum will be distributed to the Office of the Secretary of Defense for review, and to the military departments and defense agencies for further guidance in their planning activities.

While this is a new and perhaps difficult role for the Joint Chiefs of Staff, they are moving ahead. The key point is that views of the Joint Chiefs will now be expressed in the context of "real world" fiscal constraints. The Joint Force Memorandum will be of considerable influence in determining force levels and priorities for the military departments and defense agencies. Under the revised PPB procedure, the Joint Chiefs of Staff will participate more effectively in developing the Five Year Defense Program, than has been apparent in recent years.

Program Objective Memorandum

While the Joint Chiefs play a considerable role in the revised procedures, there is also a major increase in tasks and responsibilities of the military departments and defense agencies. In May, each of these components will submit a Program Objective Memorandum which proposes a total military department or defense agency program in terms of forces, manpower and costs. The Program Objective Memorandum (POM), which will be submitted to the Secretary of Defense, is the fourth and final new document in the revised cycle.

[1] *Because of the time required to revise JSOP-I to reflect significant strategy decisions, and problems inherent in implementing a revised PPB System, only one version of the Strategy Guidance Memorandum was issued in the current cycle.*

The POM will be a comprehensive and detailed presentation of the forces and manpower proposed by each military department or defense agency within the constraints of the Secretary's fiscal guidance. The POMs will also be prepared to reflect JSOP I, the Strategy Guidance Memorandum, and the Joint Force Memorandum. Individual DOD component Program Objective Memoranda will provide rationale for any significant deviation from the Joint Force Memorandum, as well as military gains and/or assessment of risk resulting from these deviations. Specific formats have not yet been provided for the Program Objective Memorandum, other than that it will be structured by major mission and support categories used in the Fiscal Guidance Memorandum.

In certain respects, the Program Objective Memoranda correspond to "For Comment" Draft Presidential Memoranda (DPMs) of the former PPB procedure. However, instead of having initial analysis and presentation alternatives prepared by the Office of the Secretary of Defense, as was the case with the Draft Presidential Memoranda, the Program Objective Memorandum is a document initiated exclusively by a military department or defense agency. And this military department/defense agency document will then be subject to review and comment by the Secretary of Defense, with the help of his staff. This is a highly significant turn of events. It places the burden of detailed initial force planning and tradeoff analysis with the military services and defense agencies, which represents a considerable deviation from previous procedures. The importance of this facet of the procedures was well summarized by Assistant Secretary of Defense (Comptroller) Robert Moot:[2]

It is easy, perhaps, to overlook the significance of this change. It requires the [military] services to think systematically about alternatives to current and planned programs. It is the [military] services who must challenge their own programs, design the structure of the analysis, perform the needed research and present their cases in the Program Objective Memorandum.

Based upon review of individual Program Objective Memoranda by the Secretary of Defense, a series of Program Decision Memoranda will be issued to reflect the Secretary's program decisions. It is anticipated that Program Decision Memoranda will be completed by the end of July. However, there is provision for DOD components to express a dissenting view to any of the Secretary's program decisions. The Secretary will direct appropriate staff reviews of any documented dissenting views. Any new decisions resulting from such review will be reflected in modified Program Decision Memoranda. It is anticipated that these reviews will take place during the month of August. Also during the month of August, the Joint Chiefs and Service Secretaries meet with the Secretary of Defense to discuss and resolve any remaining major force issues. This meeting or series of meetings result in final program decisions to be reflected in an updated Five Year Defense Program, prior to starting the budget review portion of the cycle in October.

The budget review process remains unchanged, although introduction of fiscal guidance early in the cycle should make the review less hectic.

Impact of Revised PPB

It is difficult to isolate any single item as the most significant change. However, even this brief review should serve to indicate that we will have a much more *unified* program and budget operation than in the past. While programming did, in fact, provide a bridge between planning and budgeting, it is still viewed by some as being disconnected from budgeting. The revised procedures are aimed at ensuring that program issues will translate much more readily into budget issues. There is an organizational signal being sounded here, as it is apparent that program analysts and the budget community will have to work much closer than ever before. This is true at the level of the military department and the defense agency, as well as at the level of the Office of the Secretary of Defense.

Perhaps the greatest impact of the revised system is that many detailed planning and programming decisions will be made at a lower level than before. In the past, many of these detailed decisions were made personally by the Secretary of Defense during final weeks of the cycle. The revised system will provide for a greatly increased sharing of the responsibilities leading to major decisions that annually are expressed in the budget. The presence of realistic fiscal constraints early in the year will give each DOD component a much greater voice in determining final configuration of its budget.

While there will be greater military department and defense agency participation at almost every step of the

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[2] *Address by Robert C. Moot, Assistant Secretary of Defense (Comptroller), to the National War College, Dec. 17, 1969.*

procedure, as well as increased freedom to take the initiative in proposing reallocation of proposed resources, there will also be increased responsibility for ensuring efficient and economical management of resources. And in plain, simple language, this means more analysis, an upgrading in both quantity and quality. This is particularly true when considering that a detailed program-by-program presentation and evaluation of alternatives must be assembled by each military department and defense agency in preparing the Program Objective Memorandum.

The other item of considerable significance is that programs will be designed around fiscal reality, even in the earliest stages of the cycle. Under previous procedures, a large part of the PPB cycle was spent in working on plans with total costs in excess of finally approved budgets. This necessitated frequently frantic budget trimming from October to December on a program that took nine months to structure. For example, in 1968, the $100 billion September program was reduced to about $80 billion by December, and was later cut to $76 billion by the Congress. Under the revised system, budget submissions will be within constraints of the Fiscal Guidance Memorandum, and the October to December time frame can be used for fine-tuning.

Full impact of the revised procedures will not be felt for a number of months, although some aspects of the revisions were used in preparing the FY 1971 budget. It is important to remember that the PPB revisions were thoroughly planned, discussed and coordinated throughout the entire department—Office of the Secretary of Defense, Joint Chiefs of Staff, the military departments and the defense agencies. The changes represent a composite point of view. By working as a team, DOD components should use the revised PPB procedures to make the FY 1972 cycle one of the best on record.

However, while the proposed system looks good, one must not lose sight of the wisdom quoted in the introduction to this article: "A decision-making process . . . must remain dynamic and susceptible to change if it is to retain its utility."

Economic Analysis

Ordering Spending Priorities

Edward E. Winchester

Domestic priorities versus military priorities. Cost overruns. Poor performance. Late delivery of weapon systems.

Among other things, critics of defense spending cite these reasons to support the premise that there should be more systematic evaluation of defense programs and projects from cradle to grave. General unrest with the war in Vietnam, urgent domestic needs, and the continual pressure of inflation have put this issue squarely before the Congress, the public and the Administration.

Almost a year ago the Council of Economic Advisors predicted that the end of U.S. involvement in Vietnam would bring a "peace dividend" of $22 billion. It is certain that future defense spending will have to compete with social programs for federal funds on the basis of costs and benefits. This fact is obvious from the public attention currently being given to problems of national priorities.

Some critics assert that many defense procurement practices do not make sense. For example: Because helicopters have proved valuable in fighting guerrilla war in certain kinds of Vietnamese terrain, does it make sense to spend a billion dollars equipping all Army divisions—even those prepared to fight on the open terrain of Central Europe—with a full complement of helicopters on top of their regular equipment? Why build nuclear carriers, destroyers, and frigates at nearly twice the cost of conventionally powered ships when the only advantages are very minor increases in cruising speed and range of the Fleet? These are the kinds of questions that must be addressed during the process of making economic analysis of proposed DOD investments.

Approach

In the opinion of Assistant Secretary of Defense (Comptroller) Robert C. Moot, the major objective of determining and justifying programs, priorities, and resource levels within DOD has not been achieved, but a good start has been made by management mechanisms created during the past year.

Taking stock of the Defense Department, Mr. Moot also observed,

> Every major program in the budget must be supported by an economic analysis; it must be adequately explained; its actual performance must be monitored from a financial management viewpoint. We must discipline ourselves to do this, not only to have a better justified budget, but also to have more effective and economical programs. These economic analyses must be used by management.

All levels of management are now required to use the so-called "systems approach" to evaluate the cost-benefit implications of defense expenditures. In keeping with the policy of "partici-

patory management," considerable latitude and flexibility has been given to the military services and defense agencies in deciding the methods of analysis and the amount of detail that is to be submitted to the Office of the Secretary of Defense. But, as a general rule, spending proposals will be backed up by a cost-benefit study, cost-effectiveness analysis, or a cost/output tradeoff study.

Obviously a great deal is to be gained from broader application of the systems approach to DOD decision making. The systems approach encompasses economic analysis or systems analysis, systems engineering, value engineering and cost reduction. It has the potential of helping new programs get off to a good start and assuring that obsolete programs, which have outlived their usefulness, are detected at an early stage.

A ready-made market for developing a program analysis capability is developing rapidly. The need to support defense acquisitions with sound economic analysis is causing program initiators to place greater emphasis on cost-effectiveness and cost/output tradeoff studies to justify acquisition of weapon systems and services for national defense. Economic analysis will be an important means of developing public confidence in defense programs by demonstrating that the benefits of spending proposals do, in fact, exceed the costs at any given point in time. Planners and programmers will have to examine deeply program objectives and criteria for accomplishment. The results of these analyses will have to be used in the budget process. At various stages of procurement, and at various levels of detail for a given contract work breakdown structure, an economic analysis may be useful for justifying support and production requirements. Line managers are required to analyze and evaluate the cost-benefit implications of their spending proposals. Quite often only contractor personnel will be able to make these analyses.

Economic analysis can be applied to new investments as well as to ongoing programs. It can also be the basis for evaluating activities and ordering priorities for projects subject to termination when budget reductions are being levied. Program analysis and the analytical techniques of economic analysis are at the very heart of the Planning-Programming-Budgeting System (PPBS) of the Defense Department.

Sound Spending Proposals

In this current environment, managers at all levels must *choose* efficient programs. They will engage in new programs, or continue ongoing programs, only when a convincing case can be made to show that the benefits will clearly outweigh the costs and that alternatives have been considered.

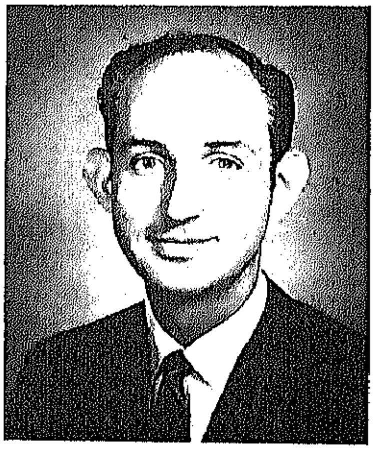
The entire spending policy of the Defense Department must operate within the framework of overall policy and fiscal guidance. This guidance comes from the President to the Secretary of Defense, and flows down from the Secretary to the planning, programming and budgeting staffs of the military services and defense agencies, to individual line managers, and to defense contractors. This "top-down" planning is one approach for integrating economic analysis into the entire decision-making process.

"Bottom-up" planning is full of implications for economic analysis to support planning, programming, and budgeting. Initial development of an investment or spending proposal is likely to be fairly low in the hierarchy of the Defense Department. Most decisions at lower levels of management are highly analyzable entities because of their scope and nature of activities. Deep evaluations of new spending proposals and reappraisal of the need for ongoing activities can be made only at lower levels because needed technical knowledge may exist only in an organizational component far removed from top management.

Zero-Base Budgeting

To put the subject in another perspective, it is important to realize that FY 1971 DOD procurement budgets aggregate more than $18 billion and consist of hundreds of individual line items. Many of these line items consist, in turn, of many subitems which, in and of themselves, may be susceptible to economic analysis. Certainly it would be impractical to try a comprehensive evaluation of all investment proposals at the level of the Office of the Secretary of Defense, where there is a staff of 10 people to review submissions which total between $20 and $30 billion. Therefore, it is necessary to look to the military services and defense agencies to provide assurances that the necessary analytic studies have been used in the budget formulation process. Obviously, only the barest start has been made to use economic analysis to order spending priorities in the Defense Department.

Customarily, the officials in charge of established programs have had to justify only the increases which they sought above the previous year's appropriation. What they had already budgeted was usually accepted as necessary, without re-examination. DOD Instruction 7041.3, "Economic Analy-



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sis of Proposed Department of Defense Investments," Feb. 26, 1969, now provides for evaluation of ongoing programs and reassessment of priorities. It adopts a modified version of the concept of *zero-base budgeting*. In iterative studies of the same investment proposal at successive decision points, when new funding is required, *e.g.*, concept formulation, contract definition, full-scale development, operation and support, an economic analysis should be prepared or updated at the point where the results of the study could influence further investments or expenditure decisions. In other words, a case must be made to justify the entire investment, just as if the program is entirely new.

DOD Instruction 7041.3 establishes policy and procedures for consistent application of economic analysis to proposed DOD investment projects in order to:

- Identify systematically the benefits and costs associated with resources requirements so that useful comparisons of alternative methods for accomplishing a task or mission can be made.
- Highlight the key variables and the assumptions on which investment decisions are based and allow evaluation of these assumptions.
- Evaluate alternative methods of financing investments.
- Compare the relative merits of various alternatives as an aid in selecting the best alternative.

Economic analysis is only a tool for determining the allocation of resources to each program and activity, and for ordering DOD priorities. With respect to costs and benefits, military service and defense agency headquarters must justify program requests and program budget submissions they deem necessary, using, whenever appropriate, the techniques of economic analysis. Ultimately, the budget of the Defense Department will tend to reflect only projects having the highest marginal benefit per dollar of marginal costs.

The Analysis Function

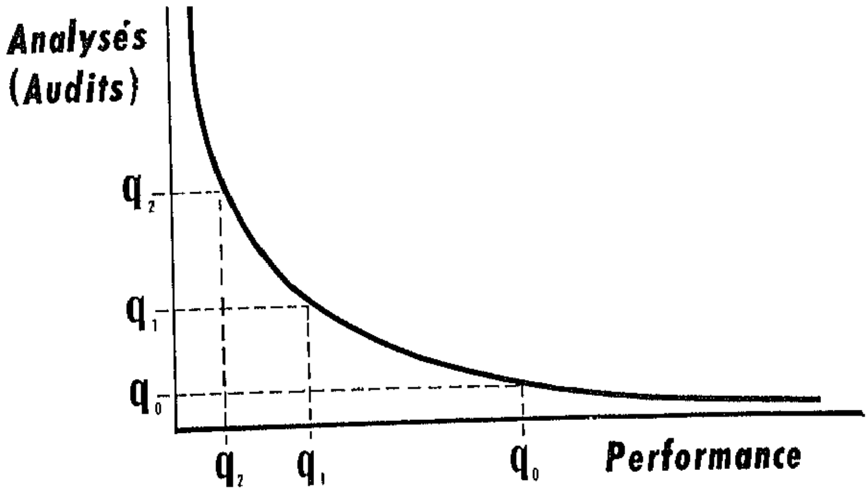

Figure 1.

What Economic Analysis Is

Economic analysis concerns itself with questions of supply and demand. However, the Federal Government deals largely in areas where there is no market place. Accordingly, one function of economic analysis is to provide intelligence about demand, whether for a desired level of military capability, a new wing of tactical aircraft, military housing units, etc.

Another function of economic analysis is to provide information to justify requests for funds to meet those demands, and to provide for ordering priorities of spending programs of the Defense Department based on their costs and benefits.

Other forms of analysis may be undertaken to increase efficiency of operations. However, the focus of attention will be on an organization's objectives and on the cost and benefits of the investments it recognizes as being important to accomplish those objectives. Emphasis is placed on ordering priorities and evaluating investments.

Strong emphasis is now being placed on decentralization in the Defense Department. Professional military people are being given more responsibility and authority for making recommendations and executing military plans. Economic analysis, as a subset of the Planning-Programming-Budgeting System (PPBS), is a major step to bring both PPBS and economic analysis "down the chain of command."

At the suggestion that proposed expenditures be backed up by an economic analysis in accordance with DOD Instruction 7041.3, some misconceptions are likely. It is sometimes said that economic analysis applies only to problems which can be quantified. Some may say it is not very useful for evaluating investments for research and development and expenditures which are justified on the basis of military necessity. Others view analysis as applying only to acquisitions of plant and equipment; only for estimating dollar savings. Some may believe that it does not involve technical and performance considerations, and unquantifiable factors such as health, safety, or security.

Fundamental to economic analysis is the concept of "open and explicit analysis." Economic analysis is open and explicit if it is presented so that the objectives and alternatives of investments are clearly defined, costs and benefits are identified, and all the important assumptions, factors, calcu-

lations, and judgments are clearly presented. From such analysis, interested parties can see exactly how recommendations were derived. Propositions can be checked for logic. Questions of fact can be tested against factual evidence. Matters of value and uncertainty can be exposed and clarified. Decision makers will know exactly where to apply judgment. Thus, economic analysis is an aid to judgment, not a substitute for judgment. It helps by isolating the potential significance of each of the investment alternatives.

The term "investment," as used in DOD Instruction 7041.3, applies to more than just capital acquisitions of plant and equipment. A definite distinction is drawn between *investment* and *investment costs*. In a broad sense, an investment is an acquisition of goods and services. This includes any expenditure, *e.g.*, leaseholds, procurement of equipment or services, and other non-capital acquisitions. An investment is an expenditure made in the expectation of realizing benefits. It may involve recurring and nonrecurring costs (research and development costs, investment costs, and operating costs), as well as tangible and intangible benefits and indicators of effectiveness and output.

DOD Instruction 7041.3 differentiates between two key economic concepts: "equal cost" (isocost) and "equal benefit" (isoquant). Its two primary objectives are:

- Identification of cost reduction/least cost investment alternatives.
- Improvement of effectiveness or performance of both new and ongoing programs.

In other words, economic analysis is primarily a set of concepts for evaluating the costs and results of expenditure.

Need for Economic Analysis

Sound economic analysis is an essential part of the process of ordering spending priorities for the Defense Department. In an environment where demand exceeds the available supply of funds and fiscal guidelines impose budget constraints, investment proposals must be evaluated on their relative merits, and priorities established. In other words, the analytical techniques of economic analysis must be used by management at all levels. It is only by determining programs and projects which are capable of attaining required objectives, programs which have outlived or attained required objectives, and programs whose benefits are in excess of their costs that it is possible to begin to lay a basis for ordering priorities. This is the purpose of economic analysis.

The relationship between the level of performance of defense programs and the amount of analysis which is needed is depicted in Figure 1. There is little incentive or demand for analysis when program performance is high. Conversely, the lower the level of performance, the greater is the need for analysis. Unfortunately, the precise position of the Defense Department on this conceptual schematic can be ascertained only by means of empirical observations and investigations.

One source of empirical data, which is useful for demonstrating the level of performance, is the Comptroller General's Annual Report. For example, total dollar collections and other measurable savings in the Defense Department for the period of FY 1965–68, attributable to the General Accounting Office, amounted to $436 million. To this figure could be added measurable savings resulting from internal DOD audit activities, and savings resulting from the value engineering, cost reduction and suggestion programs. The total amount of savings, of course, is an unknown, but it is bound to be substantial. The many reports submitted to Congress alleging waste and inefficiency, and ways of improving program performance, are other indicators of the need for greater emphasis on analysis by the Defense Department.

Changes in the level of program performance are generally caused by:

- Pursuit of new investment alternatives, options, and ways of doing business which will result in improved performance and greater efficiency.
- Failure of individuals to properly analyze and evaluate the consequences of expenditure decisions.
- Failure to control and conduct

DOD Component Regulations Applying to Economic Analysis

Military Service or Defense Agency	Implementing Document	Date
Army	Army Regulation 37–13	June 4, 1969
Air Force	Air Force Regulation 172–2	Dec. 30, 1969
Navy	SECNAV Instruction 7000.14	June 30, 1970
Defense Communications Agency (DCA)	DCA Instruction 600–60–1	June 25, 1969
Defense Intelligence Agency (DIA)	DIA Regulation 45–8	April 24, 1969
Defense Atomic Support Agency (DASA)	DASA Regulation 7041.3	Sept. 26, 1969
Defense Supply Agency (DSA)	DSA Regulation 7041.1	June 10, 1969
Defense Contract Audit Agency (DCAA)	DCAA Regulation 7041.1	Oct. 1, 1969
National Security Agency (NSA)	NSA Comptroller Memorandum No. 30	June 10, 1969

Figure 2.

ECONOMIC ANALYSIS TO SUPPORT PROCUREMENT DECISIONS

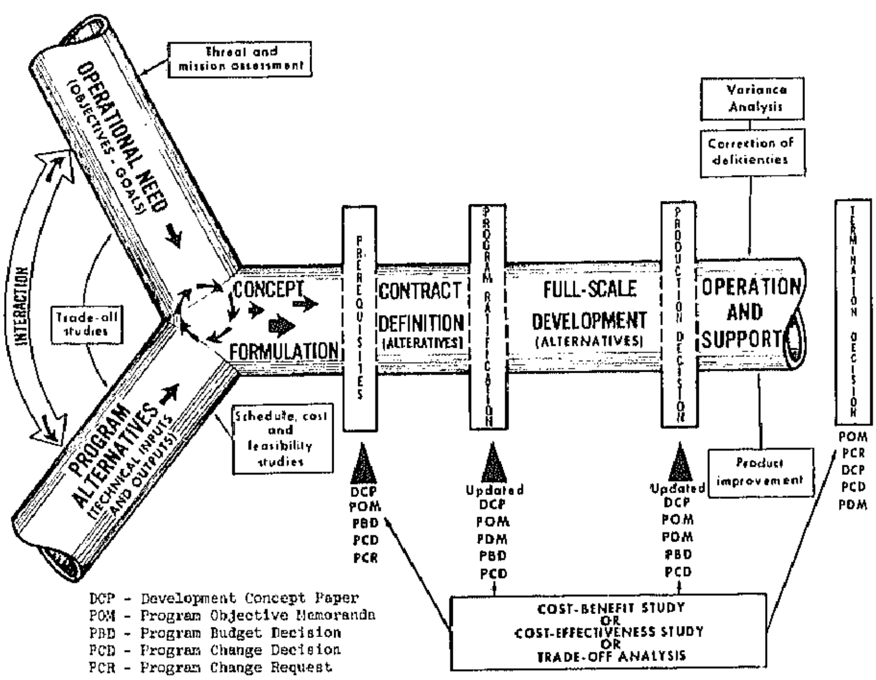

Figure 3.

adequate analysis of ongoing programs and activities.

Greater use of the economic concepts, which form a necessary part of program analysis, is one way of achieving economic efficiency and an optimum level of performance in DOD operations.

Need for Written Guidance

It is possible to have effective and efficient management systems, such as the PPB System, without written policies. But the relative formalism, which is an essential characteristic of the PPB System makes it desirable to have certain basic policies made explicit, to assure that those policies and procedures are followed. When PPB responsibilities are decentralized and analyses are made at various organizational levels, it is even more important to have written instructions to assure consistency in the application of specific policies and procedures.

Regulations implementing economic analysis in DOD components are listed in Figure 2 (page 7). These guidelines should have a significant impact on the preparation of the FY 1972 defense budget.

The basic requirement for tradeoff studies and cost-effectiveness analysis is also the heart of the new System Engineering Management Program (Military Standard 499). It provides criteria for defense contractors to follow in determining the optimum choice among technically feasible alternatives from a mission performance point of view. Military Standard 499 is, therefore, a logical complement to DOD Instruction 7041.3. The role of economic analysis in the procurement process is shown in Figure 3.

Efforts to institute economic analysis of policy issues in DOD is by no means complete. There is still a long way to go to ensure that economic analysis is incorporated in the decision process in DOD.

For many program planners the written guidelines present little that is new. Economic analysis may merely help to improve the quality of analyses which are normally done. Where it has not been used, hopefully changes will occur. Much more emphasis will have to be placed on using economic analysis, particularly in the budget process. Since the federal budget brings program priorities more sharply into focus than anywhere else, the challenge is to gain an understanding of the requirements underlying the budget and the potential impact of reordering priorities. This understanding must be communicated to all segments of our society. The challenge has been particularly acute for the DOD portion of the federal budget, since virtually all the pressure has been for decreases.

Controlling Expenditures

The actual costs and benefits of existing programs are often at a disadvantage when compared with the promised costs and benefits of proposed programs. While DOD Instruction 7041.3 currently provides only for pre-expenditure evaluations, economic analysis *per se* may be viewed as diagnostic, as well as prescriptive. Through the application of analytical techniques, it is possible to make an economic analysis or evaluation of past investments and ongoing programs and activities.

It has been suggested that DOD Instruction 7041.3 be supplemented with provisions for variance analysis of actual performance with planned performance. A "closed loop" of this nature is necessary to establish credibility for cost-benefit studies. Furthermore, performance measurement is essential to maximize actual performance, output, benefits, and savings. Otherwise, PPB will not be a "system" because it will not have a feedback capability. Users of the instruction should be alert to this particular shortcoming. There is a need to use economic analysis on a post-expenditure basis to evaluate performance, and to identify necessary corrective actions for situations which fall outside acceptable parameters.

To strengthen this control function, the Assistant Secretary of Defense (Comptroller) has requested the Service Secretaries and Defense Agency Directors to place greater emphasis on performance (output) measurement. He urged that managers at all organizational levels relate specific

goals and accomplishments to broad organizational goals by establishing goal-setting and performance measurement programs. When the missing link, performance measurement, in the existing PPB process is fully developed and implemented on a broad scale, there will be much greater likelihood of effecting increased economies and efficiencies within DOD.

Summary

From the foregoing it can be seen that, even though economic analysis stresses the use of scientific, quantitative techniques, it also makes use of expert intuition and judgment.

It is important to be specific about costs and benefits, even if it is not possible to quantify. The analyst should take a wide view in identifying the consequences of proposed expenditures and identify both quantifiable and non-quantifiable consideration—call them externalities, side-effects, spill-overs, repercussion effects, or what have you. If they are relevant and significant, they should be identified in the analysis.

It is easy, unfortunately, to exaggerate the degree of assistance that economic analysis can offer the policy maker or the decision maker. At most, it can only aid him in understanding relevant alternatives and key assumptions by providing estimates of the cost, risks, payoffs, and other implications associated with each course of action. Hopefully, it will lead him to consider new and better alternatives, and sharpen his intuition and broaden his basis for judgment, thus helping him to make better decisions.

The thrust of economic analysis is toward specificity, not quantification. Provisions have been made in the DOD Instruction 7041.3 for using various kinds of analytical techniques. Economic analysis is not synonymous with the application of computer technology or sophisticated mathematical techniques. Many important analyses may not use them. The purpose of DOD Instruction 7041.3 is to encourage careful and explicit evaluation of defense programs and activities through the use of an appropriate analytical framework.

The full benefits of economic analysis will not be realized immediately. Only as people at the lower echelons of DOD use economic analysis will its full potential be realized. However, from what has been said concerning the status of implementation, it is evident that aggressive follow-up actions by the military services, defense agencies, and defense contractors will be necessary to ensure that economic analysis is, in fact, tied into the entire decision-making process of the Defense Department.

Output Information: Ask the Right Questions

Colonel E. G. Wale, USAF

Daily, as we read newspapers and magazines, listen to political speeches, or watch the TV news programs, it becomes even more apparent that these are "dog days" for many federal activities. With public demands for goods and services growing apace with the population explosion, new technological achievements, and continuing economic prosperity, the funds allocated to many federal agencies are not keeping step with increasing demands. As a consequence. many federal agencies are faced with the problem of providing increasing goods and services with relatively decreasing budgets. From the President and Congress down through the departments to the program managers, key words in the decision-making process are "justify," "substantiate," and "prove." In this environment, every manager is pressed toward devoting considerable energies to the development of a better capability to ask the right questions.

In the past few years, giant strides have been taken by many federal agencies toward improving their managerial techniques and skills. Many promising and innovative management systems have been put into operation—some good, some bad, some resulting in auditable savings, some in expensive waste. The challenge to the Office of the Secretary of Defense (OSD) in these dog days is to take inventory, to re-evaluate our needs, to weed out the ineffective, to eliminate the extraneous, and to refine and perfect those management systems which have proved their worth—that are paying their way. In short, our role is to provide the military departments and defense agencies with policy, guidance and assistance, as well as tools that will help them to make better decisions.

Most readers will recall that efforts to introduce systematic planning, programming, budgeting and analysis into the decision-making process began in the Defense Department. DOD was the first government agency in the business. Under the leadership of former Secretary of Defense Robert S. McNamara, Charles Hitch, then

the Comptroller, and Alain Enthoven, head of the new Systems Analysis organization, for the first time developed and used performance and cost information to maximize rational consideration of, and choice among, alternatives. The success of this effort stimulated the proposal to apply a similar approach in all federal agencies and departments.

On Aug. 25, 1965, former President Lyndon B. Johnson issued an executive order establishing a comprehensive Planning-Programming-Budgeting (PPB) System throughout the Federal Government. In his words, the objectives of this system were to encourage public decision makers to:

- Identify our national goals with precision and on a continuing basis.
- Choose among those goals the ones that are most urgent.
- Search for alternative means of reaching those goals most effectively at the least cost.
- Inform ourselves not merely on next year's costs, but on the second, the third, and subsequent years' costs of our programs.
- Measure the performance of our programs to ensure a dollar's worth of service for each dollar spent.

Colonel E. G. Wale, USAF, was a management analyst in the Office of the Deputy Assistant Secretary for Systems Policy and Information, Office of the Assistant Secretary of Defense (Comptroller), when he wrote this article. He has since been assigned as military assistant to the Director, Advisory Group for Aerospace Research and Development, Paris. He holds a bachelor of science in mechanical engineering from Denver University, and a master of science in research and development management from the Air Force Institute of Technology.

Since President Johnson's directive, approximately 25 federal agencies have initiated the development of Planning - Programming - Budgeting Systems. Examination reveals that they differ widely in structure, quality and utility. Additionally, and for the first time, the FY 1970 budget is comprised of breakouts of expenditures by programs for several of the federal agencies, using accountability systems similar to those that have been in use throughout the Defense Department. The unity of purpose and utility of this kind of breakout is obvious, despite the limitations imposed by its high level of aggregation and the lack of output information or benefit measures. However, many questions about the rationale for this particular means of portraying national expenditures may be raised.

Measuring Achievement

It would appear that the most vital among these questions is the glaring and universal inadequacy of these structures to provide meaningful and useful measures of achievement and effectiveness. In general, the systems, presently being promulgated and developed, do not adequately reflect the outputs associated with the decisions under consideration, as required by the President's executive order or as expressed in Bureau of the Budget Bulletin No. 68–9.

In reviewing this bulletin, the reader will note that a program element is the basic unit of the program structure, and that its characteristics are almost completely based on output information. The definition for program elements as stated in this bulletin is:

> ***Program Elements.*** **A program element covers agency activities related directly to the production of a discrete agency output, or group of related outputs. Agency activities which contribute directly to the output should be included in the program element, or financed from different appropriations. Thus, program elements are the basic units of the program structure.**
>
> **Program elements have these characteristics: (1) they should produce clearly definable outputs, which are quantified wherever possible; (2) wherever feasible, the output of a program element should be an agency end-product; and (3) the inputs of a program element should vary with changes in the levels of output, but not necessarily proportionally.**

If we apply this definition, it is readily apparent that the development and establishment of long term program planning, and the guidance and evaluation of year-to-year program management, require generation and use of output information. Such output information or benefit measures must be capable of reflecting the degree of accomplishment of broad national goals, as well as system or organization objectives. It must be sensitive to changes in the costs expended to reach these goals.

Admittedly, problems of defining, interrelating, analyzing, and coordinating major federal programs are large and complex. Quite often there is a tendency to be overly optimistic about our understanding of a program's objectives. The usual, relatively simple "milestones" or "yardsticks" are not related closely enough to the true end values that underlie the program's purpose. However, relatively available measurement techniques, such as level of effort, work measurement, or productivity, can often meet this requirement for output information.

In addition, it is important that federal agencies establish incentives to use analytical information. Formal structures must exist within the agency to use this information in the decision-making process. Finally, the measurement techniques must specifically relate to the purposes and objectives of the program.

Without such structures, organizations as large and complex as those in the Federal Government can expend considerable resources in reporting, analyzing and evaluating information that has no real value in making decisions on proposed or existing programs.

Classes of Output Information

Class	Type of Output
A	**Social Values.** Public benefits which are equally available to all. Individuals or groups cannot be excluded from these benefits regardless of whether they contributed to their provision. Examples: national defense, law enforcement, the space program, or a TV broadcast covering a public event.
B	**External Benefits.** Products of one organization expressed in terms of benefits received by other organizations. Examples: adequacy and quality of repaired engines as received by operating units, tactical assistance resulting from effects of ordnance delivered.
C	**Organizational Products.** Description of what is produced by an organization for external use or effect. Examples: number of engines repaired, amount of ordnance delivered.
D	**Evaluated Work Measures.** Description levels of activity in terms reflecting efficiency and effectiveness through application of engineered, historical, or postulated standards. Example: earned man-hours.
E	**Levels of Activity (Unevaluated).** Number of man-hours used or units of work performed. Examples: number of overtime hours worked, number of square feet covered, number of personnel trained (without precise definitions of "worked," "covered," or "trained").
F	**Reclassification of Cost Information.** Sometimes permits output information to be inferred. Examples: number of personnel assigned; number of activities managed, dollar value of activity managed.

Figure 1.

Identifying Output Information

A vital need, at the present stage of development of PPB structures in most federal agencies, is a vast improvement in the output side of the input-output equation as it applies to resource management. An objective and pragmatic interpretation of the philosophy expressed in Bureau of the Budget Bulletin 68–9 demands a shift in emphasis from input management, or resources counting, to output management, or benefit measurement. At a minimum, a reasonable interpretation dictates recognition of the equality of input measurement and output measurement in the decision-making arena. Application of this new emphasis to PPB structures will lead to better identification of program objectives and the criteria against which progress can be measured. Additionally, it will provide more meaningful ways to evaluate the relationships between input and output, so that the decisions made and the policies pursued will more effectively contribute to the results desired.

For decisions on programs yielding products or gains which do not appear susceptible to the development of output or benefit measures, the problem appears to become particularly complex. The danger is that managers or decision makers may tend to concentrate on efforts or products which are more easily quantified. They may tend to overlook or denigrate those which appear to be incommensurable—even though the latter may be more meaningful to the true purposes or objectives at hand. Thus, the problem is compounded by the difficulties of developing meaningful and useful measures of value received or expected, even when provision is made to include output information in the PPB structure.

In this respect, an argument is often heard that federal agency outputs cannot be readily identified or quantified because they are often unmeasurable or intangible. This mistaken impression seems to arise from confusing a program's objectives or an organization's missions with its products. In reality, the objectives or missions are often intangible while the products or outputs are not. It is the former which must be better identified. Conversely, we must recognize that the mere ability to count is not necessarily an indication that we know how to measure output. The goal is to realistically evaluate the degree of efficient use made of allocated resources in getting desired outputs. Outputs are not efficient if they do not achieve the goal. Thus, programs or organizations may be effective in producing outputs, but inefficient in achieving the desired end results. This is one of the dilemmas which must be resolved.

In any complex organization, program decisions are made and resources are allocated and consumed every day. The problem which must be faced is to make better allocation and employment decisions. It seems reasonable that a better understanding and measurement of the resources consumed (inputs) and the results accomplished (outputs) of all possible courses of action will improve the decision-making processes. A thorough search for clearer identification of what must be accomplished, how it is to be done, and how to measure achievement should lead to a more systematic way of satisfying the need for better decision making.

To even the uninitiated or the casual observer, it is obvious that the Federal Government is deeply involved in the production and distribution of goods and services. The Government should, therefore, specifically identify its outputs so that they may be more properly evaluated, not merely in terms of stated programs and their associated milestones, or by reference to relative levels of effort or input workloads, but by determining the "true" value or benefit of each

output. In this respect, most students of this subject contend that the evaluation or measurement of value or benefit can best be made by that segment of the public domain which receives, uses, or consumes the goods or services produced by a program. Much progress has been achieved. However, it often seems that these requirements are not completely satisfied by several of the PPB Systems currently being developed by our federal agencies. In many cases, these systems are oriented too closely to budget and financial requirements, and many times are not directed toward answering more significant economic questions which underlie the decision-making process.

Improving Methods in DOD

During the past year, the Office of the Assistant Secretary of Defense (Comptroller) has been developing some ideas which may help resolve these problems and improve DOD's ability to ask the right questions. Further expansion and refinement of these ideas should lead to an improved ability to better identify output information in terms of the true program objectives desired, and to better relate output information to the accounting structures which have been put into operation.

First, DOD is beginning to recognize that there probably is a "spectrum," or range, of output information (Figure 1, page 11). This concept of a spectrum of types of output measures is intriguing and tentatively very useful. For example, one can speak of measures of output at the very lowest level as amounting simply to reclassifications of cost data. Moving upward in value, output might be expressed in terms of unevaluated levels of activity, in terms of evaluated work measures, in terms of organizational products, in terms of the external benefits and, at the highest level, as social values. Outputs at the lowest of these levels seem to be most easily described, and most difficult to describe at the highest. In any case, if one describes an output at the lowest level on the spectrum, it is then possible to aim for a target of describing it one level higher. This makes some

Examples of the Use of Output Information in the DOD PPB System

FYDP Program Element	Output Information	Class (Spectrum)
B-52 Squadrons	Degree of Assurance of Survival of the U.S. Population	A-Social Value
Military Survival Measures (Nuclear Attack)	Percent of Population Protected by Standard Passive Defense Measures	A-Social Value
Attack Carriers	Degree of Tactical Assistance Resulting from the Effects of Ordnance Dropped in Air/Ground Close Support of Army in Vietnam	B-External Benefit
C-5 Airlift Squadrons	Measurement Tons of Cargo Deliveries to Operational Units in Useable Condition and On Time	B-External Benefit
Military Academies	Number of Graduates Commissioned	C-Organizational Product
Logistic Support Activity	Ton-Miles of Second Destination Transportation	C-Organizational Product
Inventory Control Points	Number of Man-Hours Earned	D-Evaluated Work Measure
Hospitals	Composite Work Units	D-Evaluated Work Measure
Education Programs	Number of Students Enrolled in U.S. Armed Forces Institute Courses	E-Level of Activity
Military Family Housing	Number of Family Units Maintained	E-Level of Activity
Industrial Preparedness	Acquisition Cost of Reserve Plants or Dollar Value of Industrial Plant Equipment	F-Reclassification of Costs
Retired Pay	Number of Retired Persons on Roster	F-Reclassification of Costs

Figure 2.

of the problems discussed before a little more manageable.

Classification of output information into a formal structure, similar to this example, may assist in identification and use of the so-called unmeasurable or intangible outputs. Clarification of the true objectives of programs in terms of specific benefit measures should be enhanced. Also, building of formal PPB structures which include output information may be facilitated, thus enabling more emphasis on output information and more incentive for managers and decision makers to consider outputs as well as inputs.

In Figure 2, program elements from the DOD Five Year Defense Program (FYDP) have been selected as examples of the application of output information for each class in the spectrum. The program element is the basic building block for the PPB System.

A word of caution is necessary. The make-up of this illustrative chart might lead the reader to believe that only one output measure is desired for each program element, or that only one class of output information applies to an individual program element. In practice, the converse is true. Each program element will probably require several meaningful or critical output measures. Additionally, each class of output information may apply to a given program element, depending on the interest and level of the decision maker, *i.e.*, DOD military department or subordinate military organization, the type of function, or the organization structure. These two points cannot be overemphasized.

The second idea under consideration is a simple mechanized format which will permit comparison of forecast costs and outputs with actual costs and outputs.

At present DOD is conducting tests limited to selected program elements in the Five Year Defense Program. These tests are aimed at determining availability, validity, accuracy and utility of cost/output data, as well as the cost of capturing this information. Again, the basic building block is the program element.

Provision is made for displaying the data for each military department and defense agency which is allocated funds under a given program element. Provision is also made for DOD totals. At present, DOD envisages use of forecast costs as generated and reported in the annual budget cycle. Current-year data in this instance will probably require further breakdown into fiscal-year quarters. Actual cost data will be that currently required by DOD Instruction 7000.5, "Operations Subsystem to the Five Year Defense Program." Forecast and actual output data are being generated from currently available data for a limited number of program elements on a test basis.

While the limited data captured in our tests to date constitute a very small sample, and the application of the spectrum of output information idea is constrained by the relatively small number of organizations and functions considered, we are beginning to identify several potential problem areas. Among these problems are:

- Extremely high level of aggregation of both costs and outputs at the program element level.
- Apparent lack of uniformity of interpretation and application of program element definitions by DOD components (military departments and defense agencies).
- Wide variations in cost/output ratios from component to component for seemingly similar activities.
- Difficulties in determining or selecting the proper level of detail required to fulfill the mission of the Office of the Secretary of Defense of formulating policy and giving guidance and assistance.
- Questions revolving around the validity and accuracy of data.
- Difficulties in determining the time lapse between cost incurrence and impact on output.
- Use of discrete versus cumulative data.

A summary of this type may for the first time provide a thumbnail picture of the overall trend of a program, facilitate evaluation of the current status, and provide an overview of intra-service/intra-agency relationships. This body of data probably will not be installed in a recurring report form, but rather will be stored at the DOD component level for call-up at any time by specific users. Potential uses are "highlight" review for top level management, trend analysis, back-up for budgetary exercises, a base for organization command level reviews, and as a source for substantiation data for Program Objective Memoranda and Program Change Requests.

These applications, we believe, will significantly improve our capability to "ask the right questions."

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Muschkin, Selma, and Cotton, John. "Systematic Analysis and Grants-In-Aid in a Federal System."

Ross, William B. "Policy Analysis and Housing and Urban Development Programs."

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MEETINGS AND SYMPOSIA

MAY

Image Amplification and Photography Related to Reconnaissance, May 18–22, in New York, N.Y. Co-sponsors: Air Force Office of Scientific Research and the Society of Photographic Scientists Engineers. Contact: Dr. W. L. Ruigh, Air Force Office of Scientific Research (SRC), 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) 694–5337.

Twenty-fourth Annual **Power Sources Symposium, May 19–21,** at the Electronic Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. Co-sponsors: Electronic Components Laboratory, Army Electronics Command, and the Interagency Advanced Power Group. Contact: David Linden, Deputy Chief, Power Sources Division, Electronic Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. 07703. Phone (201) 535-2084.

Sixth **Naval Material Command Systems Performance Effectiveness (SPECON 6)** Conference, May 20–21, at the West Auditorium, State Department, 23rd St. between C and D Sts. NW, Washington, D.C. Sponsor: Department of the Navy. Contact: George W. Neumann, Executive Secretary, SPE Steering Committee, Naval Ship Systems Command, Washington, D.C. 20360. Phone (202) OXford 6–3097.

Eighth Annual **Interagency Data Exchange Program Workshop,** "Technical Information Exchange Through Interagency / Industry Cooperation," May 25–27, at the Cosmopolitan Hotel, Denver, Colo. Sponsor: Interagency Data Exchange Program. Contact: Roy W. Hall Jr., Chairman of Arrangements, IDEP Workshop, c/o Martin-Marietta Corp., Denver, Colo. 80201. Phone (303) 794–5211.

Sixteenth **Army Mathematicians** Conference, May 27–28, at the Army Strategy and Tactics Analysis Group, Bethesda, Md. Sponsor: Army Research Office—Durham on behalf of the Army Mathematics Steering Committee. Contact: Dr. Francis G. Dressel, Mathematics Division, Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285, Ext. 75.

JUNE

Phased Array Antenna Symposium, June 2–5, at the Polytechnic Institute of Brooklyn, Campus at Farmingdale, N.Y. Sponsor: Chief of Army Research and Development. Contact: Lindsay B. Anderson, Assistant Director/Chief, Radar Systems Division, Army Advanced Ballistic Missile Defense Agency, Commonwealth Building, 1320 Wilson Blvd., Arlington, Va. 22209. Phone (202) OXford 4–2752.

Advanced Planning Briefing for Industry on Naval Electronic Systems (classified), June 9–11, at the Naval Ordnance Laboratory, White Oak, Silver Spring, Md. Co-sponsors: Naval Material Command and the Electronic Industries Association. Contact: Mrs. Jane Davis, Electronic Industries Association, 2001 Eye St., NW, Washington, D.C. 20006. Phone (202) 659–2200.

Fifth **Molecular Crystal** Symposium, June 9–11, at the University of Pennsylvania, Philadelphia, Pa. Sponsor: Army Research Office—Durham. Contact: Lt. Col. Edgar G. Hickson Jr., Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285.

Heat Transfer and Fluid Mechanics Institute Conference, June 10–12, at the Naval Postgraduate School, Monterey, Calif. Co-sponsors: Army Research Office—Durham and the National Science Foundation. Contact: James J. Murray, Engineering Sciences Division, Army Research Office —Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285, Ext. 39.

Sixth **Mathematical Statistics and** Probability Symposium, June 22–July 17, at the University of California, Berkeley. Sponsors: Department of the Army, Office of Naval Research, National Institutes of Health, National Science Foundation and the University of California. Contact: Fred Frishman, Chief, Mathematics Branch, Army Research Office, Office of the Chief of Research and Development, Washington, D.C. 20310. Phone (202) OXford 4–3356.

JULY

Twenty-sixth **Solid Propulsion** Meeting, July 14–16, at the Sheraton Park Hotel, Washington, D.C. Sponsor: Joint Army, Navy, Air Force and NASA Interagency Propulsion Committee. Contact: T. M. Gilliland, Chemical Propulsion Information Agency, Applied Physics Laboratory, Johns Hopkins University, 8621 Georgia Ave., Silver Spring, Md. 20910. Phone (301) 589–7700.

AUGUST

Fifth International **Detonation** Symposium, Aug. 18–21, at Pasadena, Calif. Co-sponsors: Office of Naval Research and the Naval Ordnance Laboratory. Contact: Dr. S. J. Jacobs, Naval Ordnance Laboratory, Silver Spring, Md. 20910. Phone (301) 495–8404.

Thirteenth International **Combustion** Symposium, Aug. 23–29, at the University of Utah, Salt Lake City, Utah. Sponsors: Departments of the Army, Navy and Air Force, National Science Foundation, National Aeronautics and Space Administration, and the Combustion Institute. Contact: Lt. Col. Edgar G. Hickson Jr., Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706, phone (919) 286–2285; or Dr. B. T. Wolfson, Air Force Office of Scientific Research (SREP), 1400 Wilson Blvd., Arlington, Va. 22209, phone (202) 694–5337.

NATO Industrial Advisory Group

William C. Kruse

An outgrowth of the May 1968 meeting of the Conference of National Armaments Directors (CNAD) of the North Atlantic Treaty Organization (NATO) was a recommendation to establish a NATO Industrial Advisory Group (NIAG), composed of senior industrialists from the NATO countries. In October 1968, the North Atlantic Council passed a resolution establishing NIAG as a formal body of the council. The main purpose of NIAG is to assist and advise CNAD in stimulating increased cooperation in joint research, development and production among NATO countries.

As a high level consultative and advisory body, the prescribed objectives of NIAG are to:

- Provide a forum for free exchange of views on the various industrial aspects of NATO armaments questions.
- Foster a deeper feeling of international involvement in research, development and production, and seek closer cooperation among the industries of member countries.

The group's "terms of reference," within the scope of its activities, shall be to:

- Note information, originating from CNAD or its subordinate groups, relating to various national or common trends in future items of military equipment, and any problem upon which the advice of industry is desirable.
- Consider and comment on NATO procedures and practices insofar as they affect industry.
- Study the factors affecting cooperation at the industrial level and develop practical proposals.
- Seek and propose solutions to problems of an industrial nature, concerning particular armaments projects, which have been submitted to NIAG.
- Make recommendations for improving the exchange of information between NATO and defense industries of member countries.
- Make any other recommendations to CNAD which it considers appropriate.
- Report to CNAD.

Selection of Delegations

Following the decision by the North Atlantic Council to create NIAG, the next step for the nations was to select delegations of industrialists. All NATO nations except Iceland and Luxembourg decided to participate. The method of selection was to be at the discretion of each nation, but with an agreed general principle that the industrialists would represent their countries' industries as a whole, and that they should have latitude in their deliberations to express their industry views, not necessarily those of their governments. It was also agreed that the maximum number of industrialists in each country's delegation would be four.

The Defense Department decided to ask four major defense industry associations to select members to serve on the U.S. delegation to NIAG. Six individuals were chosen, one from each of the four associations and two chosen jointly by the four associations. As it was anticipated that it might be difficult to find meeting times convenient to all four industrialists at the same time, it was decided to appoint a total of six to ensure adequate attendance. Members of the first U.S. delegation were:

Noel B. McLean, Chairman, Edo Corp., selected by the National Security Industrial Association.

Forest W. Crowe, Vice President and General Manager, UNIVAC, selected by the Electronic Industries Association.

Willis M. Hawkins, Vice President, Science and Engineering, Lockheed Aircraft Corp., selected by the Aerospace Industries Association.

Elmer P. Wohl, Staff Vice President, Administration, North American Rockwell Corp., selected by the American Ordnance Association.

Jointly selected by the four associations were:

Mansfield B. Sprague, Vice President, Corporation Programs, American Machine and Foundry Co.

Robert Kirk, Vice President, International Telephone and Telegraph Corp.

Messrs. Crowe, Wohl and Sprague were chosen for two-year terms, and the others for one year. Mr. McLean was elected chairman of the delegation for 1969 by his colleagues; Mr. Wohl was elected vice chairman. Mr. Wohl is the 1970 chairman of the delegation.

Replacements for Messrs. McLean, Hawkins and Kirk have been selected to serve on the delegation in 1970. They are:

Robert E. Lewis, Chairman of the Executive Committee, Perkin-Elmer Corp.

Thomas J. Murrin, Executive Vice President, Defense Industry and Defense Products, Westinghouse Electric Corp.

George E. Todd, Vice President, Hughes Aircraft Co.

The term of service for each delegate will now be two years, ensuring rotation of half the delegation each year.

Administrative Operations

NIAG is headed by a chairman and vice chairman, selected from the country delegations. A planning committee, composed of the chairmen of each delegation, meets several weeks prior to a plenary session to develop agendas, and may act for and on behalf of the NIAG as a whole. A total of seven chairmen constitutes a quorum.

NIAG meets in plenary session three or four times each year and at subcommittee levels, as required. Two government observers attend plenary sessions and, if specifically invited, at subcommittee levels. Meetings at both plenary and subcommittee levels are generally held at NATO headquarters in Brussels, Belgium. Administrative arrangements are made by the NATO international staff, with assistance from the various national delegations to NATO. The staff of the Assistant Secretary General for Defense Support of the NATO Secretariat, in addition to administrative support, provides advice, counsel and coordinating services.

William C. Kruse has been Staff Director, International Armaments Division, in the Office of the Assistant Secretary of Defense (Installation and Logistics) since September 1963. Before entering government service, he was Managing Director of Sharples Italiana, Milan, Italy, a wholly owned subsidiary of Sharples Corp. of Philadelphia. From September 1960 to August 1963, he served as Director of Production and Logistics, U. S. Mission to NATO, Paris, France. Mr. Kruse holds a bachelor of arts degree in political science from Cornell University.

Within the U.S. Defense Department, the Assistant Secretary of Defense (Installations and Logistics) has primary responsibility for NIAG matters in close coordination with the Director, Defense Research and Engineering. Observers for the U.S. Government are the Assistant Secretary of Defense (Installations and Logistics) and the Director, Defense Research and Engineering, or their representatives.

All NIAG matters are routinely coordinated with the Assistant Secretary of Defense (International Security Affairs) and with the State Department and, depending on the subject, may be coordinated with other elements of DOD and other government agencies. Coordination is primarily of an informative nature, but the industrialists are apprised of U.S. Government policies or positions, as appropriate. Staff support for the U.S. delegation is provided by the offices of the Assistant Secretary of Defense (Installations and Logistics) and the Director, Defense Research and Engineering.

Moral Code

Since NIAG is unique, one of the first acts of the group was to adopt a moral code. Never before had industrialists of NATO countries gathered together in this kind of forum. It was, therefore, extremely important to develop a clear agreement of such things as organization, moral code and ethics, procedures, etc., but at the same time to remain sufficiently flexible to approach problems in a practical manner.

The moral code, on which there is unanimous agreement in principle, is:

The members of the NIAG are either representatives of industrial groups or even have direct interests in industrial enterprises themselves. This implies that conflicting interests might arise in the future, no doubt, when a start is made to work on the practical task of the NIAG. It is conceivable that information will be exchanged within the framework of the confidential projects to be discussed giving insight into the activities or interests of certain industries in particular countries. A free exchange of ideas can only take place if the members of the NIAG have the absolute certainty that nothing said within the four walls of the conference chamber could be used against them under existing conditions of competition. It is, of course, clear that no-one can be expected to forget what he has heard, but what one can expect is that all NIAG members, without exception, will have to adopt a very strict standpoint.

Security

One of the most difficult procedural problems is dissemination of information, both classified and unclassified. The information developed during meetings comes out in the form of minutes or a "summary record." Information comes from the NATO Conference of National Armaments Directors and its four main groups. It will increase in quantity if the NIAG effort enjoys any degree of success.

In the case of the United States, summary records and NATO documents are automatically distributed to the members of the delegation, the four industry associations, the Departments of Defense and State, and any other interested government agency. Over 90 percent of this information is unclassified and can be disseminated to U.S. industry, as a whole, through various means.

A reliable means for releasing classified information to industry, as a whole, has not yet been worked out. NIAG recognized this as a severe problem at the outset and formed a subcommittee to study the matter. The committee concluded that "normal NATO security regulations" would prevail. To oversimplify, this means that it is the responsibility of each NATO nation to assure that NATO security information is not revealed to any national who does not have the "need to know" and the proper security clearance. The decision on who needs to know and who will make the decision is a sticky one.

NATO Member Countries

Belgium
Canada
Denmark
England
France
Greece
Holland
Iceland
Italy
Luxembourg
Norway
Portugal
Turkey
United States
West Germany

This question is being tackled by the delegation, industry associations and DOD on a priority basis.

Flow of Information

In addition to security information, the industrialists were interested in developing procedures to pass information between NIAG and the NATO Conference of National Armaments Directors (CNAD), particularly its four main groups. The industrialists felt strongly that, in order to be effective as advisors and consultants, there must be a "two-way street" flow of information. A special ad hoc committee, composed of one representative from each of the NIAG delegations and one government representative, was formed to make recommendations.

The ad hoc group decided that there were two types of information which NIAG will need from the CNAD Service Armaments Groups: background information and specific information. *Background information* will consist of current trends, threat analyses, likely weapon systems envisaged or desired countermeasures, and all other relevant aspects of the field of defense under consideration. *Specific information* will cover proposals made by countries or NATO military authorities, or suggestions arising from the examination of the replacement schedules for equipment requested by the NATO Conference of National Armaments Directors.

Procedurally, background information will be provided by means of presentations. Subjects for presentations may be selected from the following sources:

- Inventory of subjects currently under examination by the four CNAD main groups and their subordinate bodies, to be updated semiannually.
- Classified documents giving the status of discussion of items listed in the forementioned inventory, and also to be updated semiannually.
- Suggestions by the CNAD main groups and their subordinate bodies. A separate item will be included on each agenda for this purpose.
- Requests by NIAG.

Specific information on particular types of equipment will be transmitted to NIAG from the CNAD main groups by the most suitable means.

These conclusions and recommendations of the ad hoc committee on establishing a two-way flow of information were approved by the NATO Conference of National Armaments Directors in September 1969. The mechanics of making this agreement workable are being developed with difficulties still existing on both sides. From the standpoint of NIAG, finding an appropriate industrial expert to advise in given specific areas at a convenient time is not always easy. On the other hand, armament group members are understandably reluctant to "open up" in the presence of foreign industrialists without very clear authority from their own governments. The development of appropriate confidence in one another will take some time.

Other Items and Problems

In addition to the two areas discussed herein, there has been a considerable amount of discussion on general items that present common problems to both the industrialists and the government functionaries. Among others, these involve proprietary rights; common contractual clauses; balance of payments; requirements planning; studies on economic, financial and industrial factors which affect cooperation in research, development and production; data book relative to NATO member countries' military production and industrial capacity; quality assurance policy; a special planning fund; and a fund for feasibility studies.

It was to be expected that, when groups of senior industrialists and senior government officers representing several nations met, there would be many varied views. Each project is unique with each country participating, and so-called common problems will have to be tailored to fit the specific project. These matters have been discussed at length in plenary sessions and subcommittees have been formed to develop recommendations.

Joint Benefits Anticipated

It is not likely that immediate success in significantly increasing joint research, development and production will take place. However, there is optimism, for the long run, for success in these areas and, particularly, for greater standardization and interchangeability of components and parts.

It is the consensus of all who are involved in this effort that NIAG will play an effective role in the near future in:

- Increasing understanding of NATO and NATO country problems and requirements by NATO industrialists.
- Increasing acquaintances among companies of NATO countries.
- Making specific relationships and consortia among companies in NATO countries more possible.

It is important to reiterate that the NIAG delegations represent their industries as a whole. Furthermore, the U.S. delegation to NIAG does not necessarily represent the U.S. Government. Views may be expressed quite independently of the government's views. DOD officials, however, do act as a staff for the NIAG delegation and meet with them frequently in order to exchange opinions.

Focus on Research

FY 1971 Defense Research, Development, Test and Evaluation Program

[Editor's Note: This portion of the *Defense Industry Bulletin* is devoted to a condensation of two statements before Senate committees by Dr. John S. Foster Jr., Director, Defense Research and Engineering, relating to the Defense Research, Development, Test and Evaluation Program.

The first is the Statement on the FY 1971 Defense Research, Development Test and Evaluation Program before the Senate Joint Committee on Armed Services and Defense Subcommittee of the Appropriations Committee, presented on Feb. 26, 1970.

The second is the Statement on Independent Research and Development before the Senate Ad Hoc Research and Development Subcommittee of the Committee on Armed Services, presented on March 13, 1970.]

I have given much thought to this opportunity to discuss with you the current and proposed research, development, test, and evaluation programs of the Defense Department.

My statement this year is different from those presented in the past. It is much shorter. I propose to discuss mainly the most essential issues and programs, the key matters that influence the country's defense research and development program. I will concentrate on the long range needs and not on the immediate programs. . . . Along the way, I will try to put these matters both in historical perspective and in a balanced national context.

To highlight the essential issues, I have condensed the basic case for defense research and development into four paragraphs. . . .

I believe that our life as a free and independent nation derives in large measure from the effectiveness of our defense establishment. At least since World War II, that effectiveness has derived fully as much from vigor of our national technology as from the numerical level of our forces. In fact, even when our forces were or could have been outnumbered in the past, they have been effective as a deterrent because of their technical quality. The quality of our advanced technology derives from:

- University research and teaching.
- Industrial research and development.
- DOD support of defense-related research and development, including in-house laboratories.
- Discussion of national security issues among informed, experienced, and independent individuals.

Our valuable technological superiority is today being challenged strongly from abroad. The most serious challenge comes from the Soviet Union, whose annual defense-related research and development investment caught up with ours a year or so ago and now substantially exceeds it. The effort of our national technical base is, in fact, declining while their effort continues to grow at a steady rate. I am deeply concerned about this trend.

We know that the two essential elements of our national security are: adequate force levels today and vigorous technological advances to ensure our future capability. The two essentials compete with each other, and with other national needs, for scarce funds. They can easily be confused by persons considering disarmament agreements in which it would be relatively easy to monitor force levels but almost impossible to regulate technology, especially where secrecy dominates a society. If force levels were to be controlled, we then would become especially sensitive to technological surprise. But advances in technology are essential if we are to limit, safely limit, force levels. Otherwise, we would not remain relatively secure against both surprise and possible non-adherence to an arms limitation agreement.

My conclusion is that to provide adequately for the common defense, we must ensure the continued vigor of our technology. To do this, we must ensure that the foundations of

own technical strength—in universities, industry, and DOD research and development laboratories and centers —are not weakened or separated from our technological drive.

That, in brief, is our case.

Now I want to answer the critical questions: Why do we recommend certain programs? Why do we believe this overall recommended research and development effort is critical? What are we doing to improve our management? Why do we believe that this request is, as Secretary of Defense Laird put it, a rock-bottom budget?

* * * * *

Budget in Brief

For FY 1971 we are requesting \$7,345.6 million in new obligational authority for research, development, test and evaluation (RDT&E). This is \$881.8 million less than the \$8,227.4 million requested for FY 1970. It is \$23.2 million less than the amount actually appropriated for FY 1970. In terms of actual effort, considering the increased costs of research and development, the FY 1971 request represents a 4- to 7-percent *decrease* from the FY 1970 level.

This is, based on our best analysis and judgment, a rock-bottom budget. It was formulated in recognition of other urgent national needs which must be met by the Federal Government and in full consideration of the Administration's goal of stopping the inflationary trend in the economy. We believe this budget is "rock-bottom" for three basic reasons.

- We have reexamined the need for every major project, and are requesting the minimum funds necessary in FY 1971 to assure adequate strength for our future.
- All of the supporting projects, managerial functions and facilities have been pared and pruned. There is very little slack; and we have not even added funds to meet the increased costs which result from inflation.
- Finally, we have considered carefully the technological and military challenges which the nation faces, and we have concluded that a lesser program would not be prudent.

You, of course, will apply your own judgment to each of these programs. I believe a careful review will show delicate balance between assurance of sufficient funds to conduct the programs in a reasonable way and a danger that austere funding will lead to a high risk of program failure. To minimize the risks, we have cancelled a few programs rather than cripple many. Frankly, my personal judgment is that this budget is exceedingly tight, considering our probable future needs.

. . . Figure 1 (page 20) provides data [by mission objective, by category of research and development activity, and by category of research and development organization] comparing three fiscal years. The distributions reveal the necessary continued trend toward greater emphasis on our tactical forces—to meet known and potential threats and to fix deficiencies uncovered in Vietnam. . . .

The effective level of research *effort*, measured by funding in constant dollars, is decreasing—by about 12 percent between FY 1969 and FY 1970, and by 5 percent in FY 1971—a reflection of the roughly 5-percent annual increase in the national cost of doing research. The small increase in exploratory development for FY 1971 is designed to keep some of the key technical projects at a constant level of effort so that future developments will not have to be undertaken with substantial technical uncertainties. The requested funds for the categories of research and exploratory development will not support the level of work carried out in FY 1970. Thus, we will not be able to explore some promising technical opportunities relevant to defense, and we anticipate laying off technical personnel, closing certain laboratories, cutting out many contracts, and stopping projects.

The category of management and support shows a small decrease in funding between FY 1971 and FY 1970. Thus, we will not keep up with increased costs, and will be forced to reduce or eliminate some supporting functions.

The large increases in advanced development and engineering development—including increased funding for the F-15 and S-3A aircraft—are compensated for in part by a large decrease in operational systems development, including decreased funding for the F-14, Minuteman, and Poseidon and the elimination of the MOL program. . . .

Highlights of FY 1971

I will review now the highlights of our planned research and development programs for FY 1971 which are related to strategic forces, tactical forces, electronics and information systems, and to the research and technology base. . . .

Strategic Forces. I would like to introduce the subject of research and development related to our strategic forces by reviewing the progress we have made in the last year on the newest development activities for the strategic missile force—Poseidon and Minuteman III. Both of these programs are in the flight-test phase with 15 to 20 flight tests completed on each system. . . . The success ratio of about 70 percent is high for this stage of development testing. . . .

. . . The threat to our strategic forces is the number of large Soviet SS-9 ICBMs equipped with three multimegaton warheads and the larger number of SS-11 ICBMs carrying a single warhead. As of February 1970, the Soviets are believed to have over 275 SS-9s under construction or operational and over 800 SS-11s.

At present construction rates, four years from now—in early 1974, which is the earliest any of the alternates to assure Minuteman survival could begin to be operational—the Soviets could have several hundred additional ICBMs, could be deploying multiple reliable and accurate reentry vehicles in each SS-9, and could have improved the accuracy of the SS-11. This would be more than enough to overwhelm the present Minuteman portion of our deterrent. . . .

We do not know whether or when the Soviets will stop or reduce the rate of development and deployment of their ICBMs. Therefore, we must act now to maintain the land-based missile force deterrent. We have long followed a policy of maintaining three independent deterrent forces, any one of which should be sufficient to deter nuclear attacks on us. To maintain this cornerstone national security

policy, we cannot defer corrective actions.

Safeguard is a major step to improve the survivability of an adequate fraction of our land-based missile forces.

The Safeguard objectives, as stated last year by President Nixon, are: to protect our population against limited attacks from the Chinese as well as from accidental attacks from any source; and to assure the survival of a sufficient level of our land-based strategic forces against an attack by the Soviet Union. The President also required an annual review of technical developments, the potential threat, and the diplomatic context of Safeguard.

This review has been completed. Technical progress on Safeguard this past year has been satisfactory. Meanwhile, as I have said, the offensive capability of the Soviet Union is increasing. Their forces could, in the mid-1970s, threaten almost all of our Minuteman and bomber forces. The Chinese are continuing with their nuclear program and could have operational ICBMs by the mid-1970s.

On the basis of these considerations, the President decided to request authority and funds to begin phase II of Safeguard in FY 1971. We are requesting authorization in FY 1971 to add one more Safeguard battery, in the Minuteman missile field at Whiteman AFB, Mo., and to begin advanced preparation for five more sites. . . . The deployment at Whiteman will contribute to coverage over the central United States as a part of a defense of our bomber bases against Soviet submarine-launched ballistic missile (SLBM) attacks and of a light area defense of the entire U.S. population against possible Chinese attack. This action also will provide additional protection for elements of our Minuteman force against possible Soviet attack.

If the Soviet forces continue to grow, Minuteman defense may not be economical with a system using only Safeguard radars. The cost of the existing missile site radar (MSR) makes this solution unattractive. Accordingly, the Army Ballistic Missile Defense Agency has started the development of a smaller radar which could be dedicated to hard-point defense. This radar should cost less than the present MSR which would

Estimated Distribution of DOD RDT&E

(Total Obligational Authority—Dollars in Millions)

	FY 1969		FY 1970		FY 1971	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
MISSION DISTRIBUTION						
Strategic	3,000.3	38.7	2,504.3	33.6	2,312.2	31.5
Tactical	2,258.9	29.1	2,451.2	32.9	2,600.8	35.4
Other Mission Research and Development	1,101.4	14.2	1,081.4	14.6	1,033.5	14.0
Technology Base	610.0	7.9	562.4	7.6	595.0	8.1
Support	785.1	10.1	764.6	10.3	754.1	10.3
Emergency Fund	—	—	75.0	1.0	50.0	.7
TOTAL	7,755.7	100.0	7,438.9	100.0	7,345.6	100.0
DEVELOPMENT DISTRIBUTION						
Research	404.2	5.2	368.5	5.0	369.6	5.0
Exploratory Development	875.1	11.3	857.0	11.5	897.4	12.2
Advanced Development	964.5	12.5	938.7	12.6	1,112.7	15.3
Engineering Development	800.4	10.3	1,021.8	13.7	1,395.9	18.9
Management & Support	1,226.9	15.8	1,205.0	16.2	1,167.5	15.9
Emergency Fund	—	—	75.0	1.0	50.0	.7
Operational Systems Development	3,484.6	44.9	2,972.9	40.0	2,352.5	32.0
TOTAL	7,755.7	100.0	7,438.9	100.0	7,345.6	100.0
PERFORMER DISTRIBUTION						
Industry	4,914.2	63.4	4,551.6	61.2	4,535.2	61.7
Government In-House	2,359.9	30.4	2,369.1	31.8	2,316.9	31.5
Federal Contract Research Centers	231.1	3.0	216.4	2.9	224.9	3.1
Universities	241.8	3.1	223.1	3.0	215.6	2.9
Foreign Performers [1]	9.2	.1	3.7	.1	3.0	.1
Emergency Fund	—	—	75.0	1.0	50.0	.7
	7,755.7	100.0	7,438.9	100.0	7,345.6	100.0

rch and Exploratory Development Categories.

Figure 1.

allow us to increase, if necessary, the number of radars within the Minuteman wings.

There are other ways to meet a growing Soviet ICBM threat to Minuteman: First, relocation of some of the Minuteman missiles from their present soil silos to more survivable "hard-rock" silos designed to provide much greater hardness; and, second, mobile basing of the Minuteman force into a new basing configuration such as "shelter-basing." In the "shelter-based deployment," the missiles would be located on truck-type transporters, each of which could go on warning into any one of several dispersed and hardened shelters. Such a technique increases survivability by making Soviet targeting uncertain.

Each of these options has its advantages and disadvantages. The hard-rock-silo deployment places a significant additional burden on the attacker because greater accuracy or yield, or both, is required to destroy the target. The main disadvantage is that its improved survivability can be entirely offset by sufficient improvement in the attacking missiles. The current understanding of mobile basing schemes is simply not adequate to permit a recommendation now on deployment. However, studies on these options will be completed by the end of FY 1970 and should lead to a recommendation for our FY 1971 program. Funds have been requested for this purpose.

We are not sure that the problems of land-based missile survivability can be solved permanently. In the unfortunate case they cannot, a backup is to place greater emphasis and dependence on our sea-based missile forces, now consisting of Polaris and Poseidon. The undersea long range missile system (ULMS) is our basic new program to assure a sea-based force upon which we can rely in the future.

The ULMS submarine would deploy an ICBM range missile, thus expanding by a factor of 10 to 15 the operating area as compared to that of Polaris. This would greatly complicate any Soviet effort to destroy our SLBMs. The new submarine would be quieter, optimized for its role, and would operate from ports in the Continental United States, thus eliminating any dependence on foreign bases. ULMS also would provide for the orderly replacement of the present nuclear-powered submarines (SSBNs) at the end of their operating life. We are examining this concept very carefully. With the funds we are requesting for FY 1971, a deployment decision could be made in the early 1970s.

We continue to have confidence that the backbone of our bomber force—the B-52—is effective today. However, the Soviets might be able to blunt the deterrent value of this force. One option might be to employ a portion of their growing SLBM force to reduce our warning time to just a few minutes. Another Soviet option would be to improve their air defense: by deploying an airborne warning control system to direct their high speed interceptor aircraft to engage our bombers before they penetrated Soviet territory, and by improving their terminal defense against low altitude aircraft.

For these reasons, we are moving toward engineering development on a new strategic bomber, the B-1, which could be operational in late 1977 or 1978 should circumstances warrant deployment. It would function even under reduced warning times through a combination of shortened scramble time, dispersed basing, and possibly airborne alert. In addition, we will deploy a surveillance satellite which will provide warning for our bombers that an attack is forthcoming. This would give the bomber force increased time to scramble. Improved Soviet defenses would be countered by stand off air-to-surface armed decoys and missiles—subsonic cruise armed decoy (SCAD) and short-range attack missile (SRAM)—as needed to augment the increased penetration capabilities inherent in the B-1's design.

In summary, then, all of our major strategic programs are designed to maintain an effective nuclear deterrent. Our major strategic forces must be capable of surviving a Soviet attack if they are to continue to provide a credible deterrent. And major restructuring of the strategic forces may be necessary to ensure survivability, if the Soviet threat continues to grow along present trends. Substantial progress in Strategic Arms Limitation Talks would, of course, help to keep the problems within reasonable bounds.

Tactical Warfare Programs. In general, the RDT&E effort to improve our tactical forces continues to increase—both in absolute terms and as a percentage of the overall research and development—as we provide systems needed to counter known and potential threats in the air and at sea, and as we fix deficiencies revealed in Vietnam.

Major changes have been introduced in the management of tactical warfare programs. Program management has been decentralized, and organizational changes have been made to emphasize the achievement of mission capabilities on a multi-service basis. . . . OSD will concentrate on the research and development needs in the basic long range tactical missions: land warfare, ocean control, air interdiction warfare and combat support.

Land warfare, which embraces all aspects of close combat, fire support, field Army air defense and battlefield surveillance, is undergoing major change. The most significant development activity in the area of close combat is aimed at overcoming the numerical superiority possessed by the tank forces of the Warsaw Pact nations. A major element of our effort in this regard is the main battle tank (MBT-70) program, which has now been reoriented to provide a single U.S. manager with development authority and responsibility and to reduce production cost by more than $200,000 per tank. Another particularly critical problem in the area of close combat is that posed by the mine and booby-trap threat in Southeast Asia which now accounts for a substantial portion of our casualties. Some progress is being made, although this threat unfortunately strains the technology now available to us.

In the area of fire support, technical problems with the Lance missile have largely been resolved; the management of the AH-56A Cheyenne is being revised to permit a more aggressive engineering effort; and a prototype competition for our first optimized close-support aircraft in over 20 years is planned to start late in FY 1970. With regard to field Army air defense, our deficiencies in low-altitude protection are beginning to be filled as the Redeye, Chaparral and Vulcan missiles are deployed, and our major RDT&E efforts thus are being

shifted to the SAM-D system. SAM-D is intended to ensure that modern countermeasures technology will not be able to negate our air defenses in the way we were able to overcome the Soviet-developed surface-to-air missiles deployed in North Vietnam. Lastly, in the area of battlefield surveillance, we are concentrating on exploiting the remote sensor developments of the war in Southeast Asia to give us an altogether new combat capability based on the concept of an "instrumented battlefield."

Ocean control embraces fleet offensive operations, fleet air defense, antisubmarine warfare/submarine warfare and ocean surveillance. In fleet offensive operations, an improvement in our shipboard gun and missile capabilities is needed to meet the Soviet naval threat. Our major research and development effort in this area centers on the development of Harpoon, a standoff antiship missile system capable of being launched from surface as well as airborne platforms.

The Soviet antiship missile threat remains a major concern. Major efforts related to our surface ships are: development of the Aegis (formerly ASMS) missile system and the Phalanx high-rate-of-fire gun system, which provides close-in backup defense against attacks which might penetrate the longer range defenses.

The Soviets' submarine force capabilities have increased at a rate that exceeds our prior estimates. Our antisubmarine warfare research and development programs must continue with vigor and imagination if we are to maintain the capability to counter the Soviet submarine force. Among the more important programs started in FY 1970 are the S-3A, the SSN-688 and the DD-963. We are carefully examining new technical alternatives as they develop.

Ocean surveillance programs planned for FY 1971 include an improved information processing system and the investigation of other concepts.

The air interdiction mission embraces the counterair, defense-suppression deep strike, and tactical reconnaissance roles. Within these areas, recent actions on the Air Force F-15 and the Navy F-14 air superiority fighters will have a major impact on future U.S. air warfare capabilities and are reflected in the FY 1971 budget request. The F-15 program will incorporate advances in engine, avionics, weapon (short-range missile), and materials and structures technologies in an effort to provide an aircraft system superior to the Soviet fighters of the mid-1970s. A cost-reimbursable development program with clear-cut technical achievement milestones has been issued, to be followed by a fixed-price production program. With regard to the air-to-air short-range missile, we are structuring our program to provide a common missile for Navy and Air Force use.

The Navy's fleet air defense needs (combat air patrol—CAP) will be fulfilled by the F-14A and its long-range Phoenix missile system. The subsequent F-14B/C systems, equipped with an advanced engine, will provide major improvement in the Navy's fleet defense and air superiority capabilities through improved propulsion and new avionics.

A combination of weapons, tactics and electronic countermeasures is employed for suppression of enemy air defense weapons. A major system for defense suppression is the EA-6B, which has successfully passed the "fly-before-buy" test, and is now authorized for production. Continued research and development effort is planned for the EA-6B to meet new and changing threats in the electronic countermeasures environment. Efforts are also under way to find lower cost alternatives to the Standard ARM (antiradiation missile).

The F-111 squadrons and the A-6E provide the deep strike capability. Development on these systems is essentially completed, except for continued testing and supporting technical work. The cost of deep strike missions is being subjected to careful examination. An attempt is being made to reduce the number of air munitions, both to reduce the logistic burden and to find lower cost alternatives to weapons such as Condor. In general, our basic requirement is to reduce the cost to kill a given target and, thus, we face a number of tradeoffs.

Combat support embraces tactical air command and control, logistics, training and operational support. The immediate goal of tactical control is to exchange tactical information and orders among surface and airborne fleet units (NTDS/ATDS), the Marine air control system (MTDS), the Air Force tactical control system (407L), and the Army air defense and missile control system (TSQ-73). A longer term objective is to make these systems responsive to various concepts of operations, and to ensure that future systems are compatible with those now in the inventory. We are improving airborne tactical control for the Navy and Air Force through the E-2C and airborne warning and control system (AWACS) programs. . . . The E-2C is essentially an improved version of the E-2A/B system with increased reliability and a redesigned radar which was extensively tested prior to initiating the E-2C development/production program.

In the logistics area both STOL and V/STOL concepts are being considered for the light intratheater transport (LIT) to bridge the logistics gap between intertheater transport systems and combat troops.

Electronics and Information Systems. The dramatic advances being made in electronics technology give us

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a major opportunity to improve the efficiency and overall effectiveness of all of our strategic and tactical forces. With new sensors, avionics packages, electromagnetic countermeasures, and point-to-point communications, our mobile platforms and tactical units can become more versatile without getting completely new families of major weapon systems.

New techniques and devices are being developed to provide increased capability in sensing signals and viewing operations, in processing signals and data, in transmitting information at higher speeds with greater accuracy, and adding needed automation and security to communications. Each few years often sees a tenfold improvement in these capabilities. Flexibility of installation and operation and increased survivability will also be realized. New equipment will be considerably smaller in size, lighter in weight, more reliable, more easily maintained and, in some cases, less expensive. Greater power output will be possible with reduced power consumption.

We hope that these advances will lead to the following new and needed functions:

- Permit the wider use of surveillance and target acquisition devices and provide a new capability to employ troops and firepower at night.
- Assist existing aircraft, ships and tanks to intercept, exploit, evade and/or counter enemy electromagnetic emitters.
- Provide the basis for the development of standard equipments that can be used in a much wider variety of applications and platforms.
- Greatly improve navigation and position fixing in a worldwide common grid system.
- Increase communications satellite channel capacity from 5-10 channels to some 1,200 channels, thus interconnecting hundreds of widely dispersed users in a timely and flexible manner and permitting transmission of wideband secure information over long distances.
- Permit the development of ultrareliable equipment and systems (thousands vs. hundreds of hours between failures) that will drastically reduce supporting logistics costs (maintenance personnel, spare parts inventory, training) and increase operational availability.
- Reduce the number of people overseas operating intelligence collection systems, thus reducing gold flow as well as certain risks in intelligence collection.

Research and Technology Base. I must emphasize the fundamental point of justification for the relatively basic and applied research work within the overall research and development program. To maintain strength and avoid surprise, we must know what developments in weapons are possible and practical, for ourselves and for potential enemies. We cannot afford to be the nation surprised in critical areas having long lead times for understanding as well as for development. For this reason, we have chosen deliberately, in a very tight budget, to maintain our efforts in the relevant research and exploratory development.

Defense research and exploratory development are directed dually at targets of opportunity and at identified needs. The goals are to fulfill recognized requirements in military technology and to make possible new and superior technology through the exploitation of new technical opportunities. To meet these goals requires research in the physical and mathematical sciences, the chemical and engineering sciences (electronics, materials, mechanics, and energy conversion), the environmental sciences (terrestrial, oceanographic, atmospheric, space), the biological and medical sciences, and the behavioral sciences. New and improved technological capabilities are extremely valuable in military functions, such as communication; surveillance and tracking; navigation; remote control of weapons; firepower; mobility of weapons and personnel on the ground, sea, and air; training and support of personnel; propulsion of craft and of weapons.

Section 203 of the FY 1970 Military Procurement Act was designed to ensure that public funds provided for military research and development are utilized only for projects related to specific military functions. It is important that its provisions not be interpreted so as to threaten further reduction or expulsion of DOD support for basic research, in general, and the university research community, in particular. Such a consequence would cripple defense research and technology, especially our ability to respond rapidly in time of national crisis. We must maintain a high level of imaginative technical effort in most, if not all, of the fields related to long term national security needs. Equally important, disconnecting the defense research and development program from the academic research community would deny to national defense discussions with some of the most outstanding and willing scientific and engineering talent of the country.

In the context of the changing environment we face in the 1970s, all of us must recognize that our vital base of research and technology has been declining since 1966. The overall decline in actual technical effort, *i.e.*, considering the increase in costs, has been roughly 30 percent in the past five years.

Further erosion of this base will expose the nation to the technologically based threats of the 1970s and 1980s, protected only by the technology of the 1960s. Because of this danger, I urgently request you to support this part of our request for FY 1971 in particular.

Some Fundamental Issues

Some people today seem to think that defense research and development does more harm than good. They ask: Aren't you building weapons that do not increase security but rather decrease security and increase the taxpayer's burden? Others have a "gut feeling" that new technology, all new technology, causes more problems than it solves, and that because scientists seem oblivious to the terrible social and economic costs of their triumphs, their work must be controlled by curtailing their financial support.

Most Americans do not agree, of course, but this controversy can threaten the nation's entire research and development base. It has the most profound implications for our future national security. We must talk soberly about it.

Need for Defense Research and Development in a Changing Military Environment. It seems reasonably clear that the decade of the 1960s, and par-

ticularly the late 1960s, was a turning point for the military establishment in the United States. We have been through a quarter-century of war and near-war, and during most of this period our defense needs have been awarded essentially an overriding priority. But today, as a writer in the January issue of *Foreign Affairs* put it: "Not since World War II have Americans been so uncertain about the proper role of the United States in the world."

Much of the change in the last few years has been directly concerned with the broader implications of the Vietnamese war and America's other involvements abroad. Many persons are skeptical, even hostile, about the competence, judgment, and goals of the defense establishment and foreign policy. They see no serious near-term military threat.

There is another tendency in public discussions of the Defense Department today: blaming the industrial sector for wars. This outlook characterizes the United States as inherently imperialistic and exploitative, and pins the responsibility for this defect on the "military-industrial complex" and on the political establishment as the agents of the repressive forces inherent in our structure.

Whatever weight we may assign to these beliefs, and whatever we believe individually about their validity, they do contribute to a changing political climate in this country. Thus, a new series of issues is raised. The new climate and these new issues will affect our future national security, in part by affecting the resources assigned to defense research and development and, in part, by affecting the flexibility of defense management in general. That is why I believe we must examine them.

The most fundamental issue rests upon the judgments we must make about the relationship between our capabilities and probability of serious aggression or threats hurting the interest of the United States or the interests of our friends and allies.

Consider the tension in Europe of the late 1940s, the Korean War, the Russian interventions in Eastern Europe in the late 1950s, the Cuban missile crisis, the invasion of Czechoslovakia, and the current Soviet activity in the Mediterranean. All of these threats and potential threats to American interests are impressive evidence that the Soviet leaders remain prepared to act or threaten to act militarily, with major international consequences, whenever their perception of the political-military situation suggests to them that such action is in their interest and feasible. How many more such threats and actions might we have seen had we not possessed technologically advanced capabilities? Clearly, although we are moving into an "era of negotiation," trying to shore up and broaden the emerging détente, we must remain prepared for possible confrontations.

Because of the overriding significance of strategic stability during this nuclear era, past and future, the United States has emphasized strategic nuclear deterrence. Successful deterrence requires advanced technology to ensure that our retaliatory threat continues to be credible. Further, we have required general purpose forces for those missions necessary to support our security commitments and our allies. These missions also require, in some cases, sophisticated technology for a variety of combat and support functions.

There seem to me to be two central lessons in the history of national defense needs and threats since World War II. First, as the Durants said in reviewing *The Lessons of History*: "Peace is an unstable equilibrium, which can be preserved only by acknowledged supremacy or equal power." While we must take certain risks to achieve secure and lasting peace, too many risks taken in the interests of peace can at some point become in themselves the threat to peace.

Secondly, we see even greater evidence today that research and development are essential to a prudent national security effort. The reasons for this are essentially the same as in the past, but they require special emphasis today. Let me reiterate these reasons as you consider the budget request.

First of all, research and development provide a qualitative advantage required to compensate for any numerical inferiority which the United States has or might suffer in troops or equipment and for any temporary disadvantage we might suffer should a numerically superior force take the initiative. If we maintain our technical leadership, we can achieve our goals—sometimes at lower operating costs—without necessarily competing with the Soviet Union in total numbers of missiles or bombers or troops. Thus, the quality of our deterrent may be more critical than the quantity of our deterrent—and without research and development you cannot have this quality: You would not have it now, and you will not have it in the future.

The second general argument for defense research and development is that knowledge creates options which the President *may* need during a period of tension, or during planning, or during negotiations. It is much safer to know what might be feasible in weapons than to have to guess about what a potential enemy is capable of doing. This "option-creating" function is important also because it permits the Defense Department to respond more rapidly and effectively to large changes in national security policy where such changes are caused by increased tension or decreased tension. We can be prepared to substitute new equipment for old if this improves the effectiveness of our forces, or would improve the effectiveness of an arms control agreement.

The third general justification for defense research and development is that the nation needs as broad as possible a conceptual basis for arms control negotiations, for war, or for a provoked, renewed arms race. We need to act intelligently on national security, including arms control, by considering the broadest possible range of technological possibilities.

My point here is a direct one. To cut the research and development program today is, in effect, to claim great precision in a prediction of the nature of the world in 5 to 20 years and to foreclose on the option of our future leaders who will have the responsibility for our national security at that time. Certainly, let us try hard to cut the costs of the overall defense burden and to negotiate acceptable treaties limiting weapons. But let us not mortgage the future by dismissing or misjudging the critical

—and growing—need for defense research and development.

National and International Significance of Strong Research and Development Activities. Now I want to discuss the significance, on a comparative basis, of our overall national and international technical position. Closely related are the policies affecting the way in which defense research and development interacts with the rest of the national technical base.

Let us begin with obvious questions. What is the national technical community, the "national technical base," that research and development managers talk about? Why is the base important—to national security and other national goals?

Normally the national technical base is assumed to be the sum total of all of the research and development completed and being carried out in the country. Expressed in funds, this is about $27 billion in FY 1970,[1] roughly 55 percent of federal funds and 45 percent of non-federal funds (which includes independent support from corporate, foundation, and university groups as well as funding from state and local governments). Expressed in technical manpower, this represents about 800,000 professional scientists and engineers and 850,000 supporting technical people. Now we should see what this means.

The following data help to put the U.S. technical manpower base in perspective with respect to the Soviet Union, the only other nation now comparable to the United States in technical strength:

Annual College Graduates
(Thousands)

	1955	1960	1965	1970 (est.)
USSR				
Engineers	67	102	176	240
Scientists	23	33	33	35
Nontechnical	179	192	222	305
Total Soviet	269	327	431	580
U.S.				
Engineers	26	31	36	45
Scientists	22	43	68	71
Nontechnical	255	305	436	664
Total U.S.	303	379	540	780

[1] *"National Patterns of R&D Resources, 1953–70," National Science Foundation, NSF 69-30, dated September 1969, page 14.*

It is helpful to project current trends forward in time, based on rough estimates, to appreciate the cumulative impact of continued growth rates in Soviet research and development manpower:

Total Full-Time Research and Development Scientists and Engineers
(Thousands)

	1969	1971	1985 (est.)
USSR	550	610	800
U.S.	540	570	600

These manpower data show an impressive Soviet commitment to the training of engineers—and, overall, a strong Soviet effort in all technical manpower fields—compared to the United States. It should be pointed out, however, that some Soviet engineers are actually engaged in nontechnical tasks, as well as in tasks that in the United States are adequately performed by technicians and foremen rather than engineers. Therefore, although I am not inclined to believe that there is much difference in the overall quality of training for comparable technical categories between the United States and the USSR, the United States does appear to use its technical manpower more effectively.

Comparative funding data for research and development in the United States and the USSR—data that are probably accurate within about 10 to 20 percent—look like this:

Research and Development Funding
(Billion 1966 dollars)

	1955	1960	1965	1968	1970 (est.)
USSR	3.5	7.8	13.9	17.7	21.8
U.S.	5.1	13.7	20.6	25.4	24.6

Three points drawn from RDT&E funding data should be examined seriously. First, total Soviet research and development has been growing faster during the past decade than total U.S. research and development. For example, the U.S. total funding was almost twice that of Soviet total in 1960, and by 1970 the U.S. total was only about 15 percent greater. During the last few years, Soviet research and development has been growing by roughly 10 percent per year while U.S. research and development effort has essentially leveled off. For the entire decade of the 1960s, Soviet research and development devoted to military, atomic energy, and space applications grew by about 13 percent per year, and this vigorous growth rate appears to be continuing. These budget data have been found to be consistent, on a general program basis, with the resources required to support the growing numbers and types of aircraft, missiles, ships and other equipment which the USSR has been developing in recent years.

Second, the USSR continues to emphasize military/space/atomic energy research and development. For example, looking at the military component alone, during the 1960s the Soviet military research and development increased by about 60 percent while the U.S. military research and development increased by roughly 30 percent. Overall, Soviet funding for military/space/atomic energy research and development is now about $16 to $17 billion while comparable U.S. funding is about $13 to $14 billion. In the last two years, however, the USSR has shown considerable concern over the lagging technological level of its civil industrial base and appears to be adding resources to this sector, but not at the expense of continued growth in their defense, space, and atomic energy efforts.

Third, we should note that cumulatively and currently, the United States has a substantially larger investment in research and development than the USSR. During 1960–68, U.S. research and development amounted to about $173 billion, while Soviet expenditures were somewhat more than 50 percent of that. Nevertheless, the U.S. activity is much more heavily weighted toward civil research and development (in 1968, roughly $11 billion out of $25 billion total) compared with the Soviet proportion on civil research and development.

Let me raise one final point regarding the overall U.S. technical base. Recent analyses by the Commerce Department staff have suggested that an important reason for our country's balance of payments problems and for our industry's competitive marketing difficulties abroad is that the United States no longer has a predominant position in "technically intensive products."

Many foreign countries are driving hard toward "technological parity" with the United States and, in some

important cases, have already surpassed us. Japan, for example, relying upon a labor force one-half as large and not quite as well educated as that of the United States, is advancing almost spectacularly across almost the whole spectrum of advanced technology. Japan's growth rate in technologically intensive manufactured products was 22.5 percent per year during 1955-65, compared with the United States at 3.9 percent per year and West Germany at 8.4 percent per year.

The latter data and perspectives are largely concerned with civilian high technology activity rather than with exclusively military activity. Nevertheless, it would be superficial and perhaps hazardous not to assume that, when other nations' capabilities for advanced technology are already strong and growing rapidly, this has some significance for our long term national security.

In general, then, I urge you to consider the broad pattern of our national technical base. Examine not only the merits of the individual research and development efforts of all Federal agencies, but also keep in mind our country's overall comparative international position. After reviewing this situation myself, my judgment is that the United States must move toward a much more vigorous commitment to national research and development, both military and civilian-oriented, upon which our long term national technological position can be strengthened.

There are two other points I want to touch on briefly regarding the way in which defense research and development fits into the national technical activity.

First, some observers have asked: Why does every agency support its own research and development activity? Doesn't this lead to overlapping and duplicating work? The answer is straightforward.

For an agency to improve its effectiveness in fulfilling its mission, it must experiment with new approaches and evaluate them against existing methods. Research and development provides tools used to achieve our objectives. Research and development, thus, cannot be conducted effectively unless it is coupled as tightly as practical to the organization responsible for attaining the objective. In the last few years, this has been proved again and again as the newer civilian agencies have discovered the needs for—and the power of—serious research and development efforts. Further, for the national research and development base to be healthy in the long term, each agency's research and development program should include some relatively basic research—to deepen our understanding of fundamental problems. In addition, an organization such as the National Science Foundation must assess the national scientific base and support many key projects itself, including some designed to fill in the gaps left by the mission agencies' technical priorities, so that the country has an adequate and balanced total scientific effort. This overall federal pattern—"pluralistic" support of research—includes little or no unnecessary duplication—and the crucial reason is that no scientist or engineer wants to duplicate another investigator's work unless he has a very good purpose.

A second issue raised by many in Congress is: Why aren't there better measures to gauge the need for research and development and better measures of the quality and the payoffs of the research and development being supported? Frankly, we share this impatience, but no one can know what fruits our labor will produce—that's why we labor.

As I will discuss later, we are working hard on many improvements in research and development management. But especially for basic and applied research, I will be candid: There is no valid "formula" that demonstrates how much is enough, how well the work is performed, and how much work in each technical field is optimum. Within DOD we depend upon the judgments of competent scientists and officers in the military research and development community, tempered by technical reviews in my office and subjected to the criticism of experts from industry, universities, and the Federal Contract Research Centers. We are prepared to justify each project in terms of quality, relevance, and cost—and to discuss the many payoffs achieved from past research. We are studying a number of new resource allocation procedures and program evaluation methods. Nevertheless, at this point no one has a comprehensive and quantitative management "system" for research.

What I have said so far can be summarized in two points. First, our past national position of technological leadership is being eroded and is being challenged seriously by both our friends and our potential enemies. I am deeply concerned about this trend for national security. Second, the federal research and development management is strongly aware of its responsibilities to avoid any unnecessary work during this period of tight national budgets and fierce international technological competition. We believe we are making every research and development investment count to our advantage.

Issues Affecting Defense Research and Development. Two current criticisms of all research and development—insufficient concern with the consequences of using new technology, and excessive federal support of research and development—have, of course, been focused on the Defense Department. I think we should discuss them forthrightly.

Some have argued that, because other national needs should be assigned a higher priority in the future, defense research and development has therefore become less important than the research and development related to other national needs. Some critics add that the Defense Department has dominated university research for too long and that this situation should be changed. Let me give you the facts.

To begin with, over the last 30 years the Defense Department's share of the national research and development activity has declined significantly. In the late 1940s, most of the federal support of the nation's research and development was provided through the Defense Department. Today, the situation is quite different:

- More than half of the total Federal expenditures for research and development (about \$8.2 billion out of \$16 billion) is provided by civilian agencies[2].
- Almost 75 percent of the total

[2] *Special Analysis Q, "Federal Research, Development, and Related Programs," Bureau of the Budget, February 1970, p. 266.*

national expenditures for research and development (about $20 billion out of $27 billion) is provided by civilian federal agencies and independent (*e.g.*, industrial) organizations.[3]

- More than 85 percent of the federal support for academic research and development (about $1.3 billion out of about $1.5 billion) is provided by civilian agencies[4].

These facts squelch the popular assertion of "Defense Department dominance." And they make it clear that the nation's many growing needs for civilian technology are already reflected in the changing national pattern of research and development. Although I am concerned that the level of defense research and development may be too low, I support the further growth of civilian research and development.

Another often discussed criticism of defense research and development is that it inevitably and uncontrollably feeds the arms race. The notion is that technology once shown feasible will inevitably be developed into full-scale hardware, that the hardware once demonstrated will be bought in quantity, and that the hardware once deployed will lead to counterdeployments by our potential enemies—thus, that arms procurement accelerates while real national security deteriorates.

This is a gross caricature of fact. There is no social institution or human activity which cannot be used for good or evil, peace or war, for attack or for defense. Technology may be used in either arms race or arms control. It is much less the state of technology and much more the state of world politics which determines the use of technology in international affairs. Yet whatever the political-military environment, the modern nation which turns its back on technology is doomed to a second-class existence. I can specifically relate military technology to the arms race by two threads of rational argument.

First, first-class, defense-relevant science and technology slows the arms race. For example, it preserves our security by decreasing the possibility of a technological surprise which could destabilize world security balances. No one wishes to have a "Sputnik," and a 10-year catch-up period in national security. Further, defense research and development helps to make arms control agreements possible by decreasing the risks should such arms control treaties be broken. No one wishes to have a Pearl Harbor after a major arms control agreement. And by providing options for qualitative improvements, research and development often enables us to avoid the need for large increases in the size of our forces. Finally, defense research and development serves as a general "safety device" and "insurance" in that it permits technical experts to understand and apply facts and judgments to defense decisions. Just as no one wishes to have our troops, if and when called to combat, equipped inadequately, no one wishes to have the technological aspects of an actual or potential threat analyzed by persons who do not have access to first-class technical knowledge.

Second, it is a combination of civilian leadership and public control that makes the decisions about the application of available technology. Decisions about every major procurement are subject to intense reviews by the Secretary of Defense, by the President and by the Congress. In these reviews, we are deeply concerned about the possible consequences of using new technology. We do separate clearly the issues of whether-to-research-and-develop from whether-to-deploy. We do question the need, the real and potential threat, the costs. Many possible systems are rejected for many different kinds of reasons. For example, the President's recent decisions on chemical weapons, biological weapons, and toxins show our willingness not to pursue some lines of research and development and to accept some military risks when this appears to be in the country's broader interests. Because of the open debates, and because of civilian leadership at all critical decision points, there is no necessary or inevitable connection between the availability of technology and the promotion of the "arms race."

For these reasons, defense research and development is a "hedge" against the unknown and is a reservoir of concepts and talent required to ensure our security. There is no "mad momentum" inherent in this outlook.

Improvements in Management

Every year for many years, senior officials in DOD have explained not only the achievements of research and development, but also the problems in research and development management and our efforts to solve them more efficiently. The main reason this subject has received so much high level attention is that it is in many respects our most important and most difficult task.

Critical Need. Today, the need for better research and development management is even more critical. We expect to restore the confidence of the Congress and the nation in DOD management through convincing actions and, thereby, earn the respect necessary to forestall reductions in funds that might well threaten our future security.

All of you know that developing new systems is inherently risky. You know that even if management were perfect, unpredictable factors always emerge, such as changes in threat, changes and surprises in technology, unpredictable engineering problems, the opportunity for further improvements in capability, inflation of the economy, and changing national priorities. You also recognize that, if the country is to be prepared for a possible threat in 1975 or 1980 or 1985, we must start now. This means trying to predict the shape of a possible enemy's forces and technology—through a curtain of secrecy—and being able to cope with them for up to two decades into the future. In formulating and carrying out programs, we must make all of the difficult judgments about all these factors far in advance.

You have heard all of this before. And you have heard what I believe was sincere testimony discussing the actions intended to improve management in this complicated environment. Some significant advances in efficiency and control were made in the past. But that testimony, those actions, and those advances were not enough. Costs have continued to grow. Some

[3] *Ibid, and "National Patterns of R&D Resources, 1953–70," NSF 69–30, p. 14.*

[4] *Ibid, p. 257.*

RESPONSIBILITIES OF SECDEF AND SERVICE

	CONCEPTUAL PHASE	PROGRAM DECISION	VALIDATION PHASE	RATIFICATION DECISION	FULL-SCALE DEVELOPMENT	PRODUCTION DECISION	PRODUCTION	DEPLOYMENT
SECDEF	X	●	X	●	X	●	X	X
SERVICE	●		●		●		●	●

RESPONSIBILITIES WITHIN OSD

	CONCEPTUAL PHASE	PROGRAM DECISION	VALIDATION PHASE	RATIFICATION DECISION	FULL-SCALE DEVELOPMENT	PRODUCTION DECISION	PRODUCTION	DEPLOYMENT
SECDEF		●		●		●		
DDR&E	◑	◑	◑	◑	◑	○	◑	
ASD (I&L)		○		○		◑	◑	◑
ASD (C)	X	○	X	○	X	○	X	X
ASD (SA)	X	○		○		○		

● PRIMARY RESPONSIBILITY ○ SECONDARY RESPONSIBILITY IN OSD

◑ PRINCIPAL RESPONSIBILITY IN OSD X MONITORING RESPONSIBILITY

Figure 2.

programs have failed to meet or even come close to initial goals.

So the hard question today is: What have we really done in the first year of this Administration? Have we taken decisive and substantial actions to improve our research and development management? Or do we offer nothing more than additional explanations and further pleas for understanding?

Actions. We *have* taken a number of important actions. I want to outline briefly the range of actions we have taken recently. . . .

The first broad category of new action is in the *redefinition, clarification and delegation of responsibilities in the weapon systems acquisition process throughout the department.* Let's see precisely what this means.

[Figure 2] defines responsibilities of the Office of the Secretary of Defense (OSD) and the military services at each stage in the process of acquiring major weapon systems. Defining these responsibilities, especially at the critical transition points, is fundamental to the new management policy set in motion by Secretary [of Defense] Laird and Deputy Secretary Packard.

Let me explain the three primary OSD responsibilities indicated in Figure 2.

In the past, DOD often was placed in the position of trying to fulfill overstated requirements with underdeveloped technology. Now, before we make the initial major *program decision,* we will review in detail and objectively the actual user needs, and then ask for only the technological capabilities needed for the minimum requirements. In short, we will ask only for what we really need and match the available technology to that need.

Following the contractors' submittals and military service validation, we will again review the initial program decision to make a formal *ratification* that the requirement is still sound, and that the technology is, in fact, available or can be developed along reasonable lines.

Finally, we intend to convince ourselves that the development has been completed fully before we make the *production decision.* We will confirm the technological achievements and establish the basis for an essentially risk-free production effort based upon realistic costs and schedule estimates.

Implementing this new policy has the overriding priority among my responsibilities.

The functions of my office, of the other offices within OSD, and of the services have been redefined. This action, which delegates more authority to the services to run programs once they have been approved, has clearly defined the office of the program manager as the place where accountability rests when decisions must be made and problems solved.

Within my office there is a new emphasis on more focused attention to broad mission areas on a multi-service basis, *i.e.,* the analysis and planning for department-wide reviews of policy, rather than detailed management of weapon systems.

Within the services, the senior officials and project managers now must confront much more clearly the priorities and tradeoffs within a constrained budget. Accountability for the development and production of systems now clearly rests with the program managers and the Service Secretaries. I think this is extremely important. The key people on our major programs know their responsibilities and know the range of their freedom of action. These are powerful management tools in which we have great confidence; I believe they should have been used more fully in the past.

My office, like all major technological enterprises, deals with a combination of technologically based "functional" problems, such as ordnance, guidance, or propulsion, *and* individual projects within each of these functional areas. In the late 1950s the office was organized by functions. During the 1960s, the emphasis shifted toward management of individual projects. Our new reappraisal of the needs of DOD in relation to my office leads us to the conclusion that we may have gone too far in managing by project, without an overview of the related projects and supporting technologies.

Accordingly, a second broad category of new actions, and one we are just beginning to move into deeply, is *mission analysis.* By this I mean the development of new policy and planning instruments similar to the Development Concept Papers (DCPs) which we have used in the past. The new "area papers"—imposing an explicit discipline of analysis just as the DCPs have done—will treat DOD-wide needs in areas such as air-to-ground attack, electronic countermeasures, and air defense, as well as areas of technology such as the environmental sciences and material sciences. Through collaboration of OSD and the services, we are setting the essential performance, cost and schedule requirements and establishing clearer priorities.

Given a clearer understanding of

program objectives and given a new management environment through greater delegation, we are prepared to *set up and monitor programs.* Thus, the third category of new actions is designed to streamline and sharpen the way in which each individual program is established and then is carried out. There are a number of actions that we have taken to help assure that programs are "ready" when we approve them and assure that they stay on track as they move through their life cycle.

One of the most important management actions was to introduce the *Development Concept Paper* which, as you recall, we began using in late 1967. In the last year it has become an even more significant part of the management approach within OSD.

The DCP is a summary top-management document for the Secretary of Defense that presents the rationale for starting, continuing, or stopping a development program at each critical decision point. It identifies the issues in each decision and assesses the important factors, including threat, risks, full military and economic consequences, and the pros and cons of each alternative. The key performance goals form the basis for program "milestones," a new concept I will discuss in a moment.

The DCP has become the principal decision-making instrument in setting up a major program. Once the Secretary of Defense has approved the DCP, it is a "contract" between the Secretary of Defense and the implementing Service Secretary to define the latitude of the service in managing the program within the thresholds for cost, performance and schedule that have been mutually selected.

Monitoring programs on a broad policy basis, when a program starts and throughout its life, is done by the new Defense Systems Acquisition Review Council (DSARC) established by Deputy Secretary of Defense Packard last year. The DSARC brings together the principals who considered the DCP for a personal face-to-face, focused dialogue when the service proposes to advance the program past a key milestone.

Thus, the DSARC discussions complement the DCP process by monitoring progress and reviewing the program status at the critical milestones. This is important when we must decide how much more early experimental work and competitive prototyping should be done. It is equally important when we move from development to production, a point at which poor decisions can be so costly in dollars and operational capability. In addition, the DSARC emphasizes the analysis of all cost data to assure that cost estimates are realistic.

One aspect of program management that we have been emphasizing this past year is scheduling by achievement in order to assess and minimize technical risks and uncertainties at the most efficient times. We do this by applying milestones to major systems contracts. Applying this milestone concept widely and systematically—and explicitly in contracts—is one of the most important innovations in management since I have been the Director of Defense Research and Engineering. The concept requires that specific achievements, such as avionics integration or successful flight test, be met by hardware tests before additional major financial commitments are made. Designing the milestones serves to bring together the key people from both the technological and systems planning areas so that every major "hurdle" in a program is discussed fully and passed clearly. With these milestones, each additional program commitment is made only *after* a goal has *actually* been reached rather than when it was *scheduled* to be reached. Most commonly, this has provided rights to the Government to delay the exercise of production options if specified milestones are not met.

Another new emphasis in setting up a program today is the *management review* which is designed to evaluate—and change, as necessary—the management framework proposed or in operation for each program. This review covers the choice of project manager and his key personnel to ensure that they are first-class technical managers and can stay with the program for as long a period as necessary. This review also assesses the line of communications and assignment of responsibilities for the entire program, and the procedures used for supporting functions on planning and procurement. The management review focuses on the elimination of unnecessary reports and paper work from the time we circulate requests for proposals.

Overall Objectives. Let me try to pull together the basic elements of our view about where we're going with these management actions.

Research and development represent one of the tools used to achieve the objectives of the Defense Department. Thus, all of the changes I have mentioned can be regarded as part of an evolutionary process of improving the techniques for defining the way in which the "research and development tool" will be used. For example, a DCP is a program decision document; it makes research and development policy and, in addition, it helps the officials in DSARC to control each research and development program and to change related policy when necessary.

Finally, the crucial point and future challenge in all of our actions is to "design to a price" instead of trying to control costs after the fact for those new systems which are required. All of us throughout OSD and the services must give and are giving this type of cost consciousness absolutely first priority.

The single most influential long range goal is to eliminate a syndrome which has grown up in the last decade: incorporating the most advanced technology into every system regardless of the cost. This syndrome pervades much of the initial design thinking at the working level throughout DOD and throughout defense industry. We must get the message throughout the system that we will not stand for unnecessary complexity and that price has as much priority as any other requirement. We must move toward the technical demands of a new kind of design in which the performance-price tradeoffs are assessed in ways similar to the design of commercial equipment.

All of our new management actions have this as their unifying theme: Control and reduce costs, and control the system acquisition process within a reshaped management environment that fixes accountability more clearly and delegates greater authority to the military services.

Focus on Research

Independent Research and Development

Statement by Dr. John S. Foster, Jr., Director, Defense Research and Engineering, before the Senate Ad Hoc Research and Development Subcommittee of the Committee on Armed Services, March 13, 1970.

I would like to use this opportunity to tell you how we visualize the particular significance of this industrial technical effort [independent research and development (IR&D)], in terms of its value to DOD as a customer and of its necessity to industry. I will then briefly describe the controls we exercise in these areas, discuss a few of the more important issues, and finally offer our proposed plan of action.

Significance of IR&D

Private companies that provide technology-based products and services, whether for the Government or for commercial customers, must maintain an active in-house advanced technology base to assure a continuing ability to respond with minimum delay to changes in customer needs. Such technical activity is also used by a company to open up new areas of technical interest, to guide other large scale research and development efforts, and to meet changes in customer priorities. . . . The cost of this new product development has been traditionally treated as a normal cost of sales or overhead [and is recovered through sales to all its customers]. . . .

From the customer's standpoint—in particular, with DOD as the customer—IR&D provides a number of benefits.

Complement to the DOD Technology Base. From a technical point of view, we look upon this broad vital base of industrial technical effort as a complement to our contracted research and development, particularly in the areas of research and exploratory development. We in the DOD are not—and must not become—so presumptious as to believe that we alone, within the limited defense research and development community, have the wisdom and ability to judge all those technical projects and approaches that may produce beneficial results. . . . In this way, we take advantage of the talents of the leaders of industry—eminent engineers and scientists—who manage the majority of our defense research programs through our major development contracts.

Forerunner to Contract Research and Development. Also, we benefit by having technical feasibility demonstrated by contractors that are performing experiments and, subsequently, analysing the data. Often this kind of effort leads to contracted research and development work aimed directly at meeting important military requirements. . . .

Lead in to Full-Scale Development and Production. While the main thrust of industry's IR&D effort is technological, there are instances in which this technical effort has resulted in a contractor's in-house development and demonstration of technologically advanced hardware prototypes. . . . It is also true that, without these on-going technical programs in industry, it would take longer and cost more for a contractor to develop a product for us under contract. Because the contractor contributes to the cost of IR&D, we get more than a dollar's worth of work for the dollar we expend.

* * * * *

Producer of More Than One Technical Solution. Closely akin to proof of technical feasibility is the fact that, when several contractors are doing technical work in the same area—with the same objective, we are given an opportunity to compare different technical approaches; thus, we can choose the one which, at that particular time and under the prevailing circumstances, offers the best solution to the problem at hand. This would not be possible if the work were being funded out of company profits, without the arrangements governing IR&D. While this, from a technical view, is evidence of our need for this kind of work by industry, we also receive non-technical benefits. . . .

* * * * *

IR&D Controls

The controls that are present in connection with IR&D expenditures by contractors are twofold. First, there are the natural competitive forces of the marketplace and, second, there are the additional controls that have been imposed for many years by DOD.

Natural Controls. Two factors motivate defense contractors to keep IR&D expenditures at an acceptable level. The first is the need to keep total overhead expenses within reasonable limits, because to ignore this fact could well mean the loss of new business. The second relates to the impact of the content and quality of a contractor's IR&D program upon his capability. Technological competition provides a strong stimulant to force companies to invest wisely in technology so as to ensure their future survival. Contractor top management must pay close attention to the choice, planning and execution of its IR&D programs. In many respects, this pressure is as effective as any system of review or regulation that we could devise.

. . . I am convinced that these forces do exist and that they do have

a significant impact on the size and efficiency of contractor IR&D programs. However, these do not provide the strength and certainty of control that we feel is necessary. It is for this reason that we have imposed specific controls to supplement the natural forces I have just described.

Government Controls. The present system of managing IR&D casts the Government (DOD) in the role of the customer who broadly specifies his needs, and industry in the role of the innovator who is responsive to those needs. To fully appreciate how the system works, it is worthwhile to briefly look at current DOD procedures . . . in the management of IR&D. First, let me describe the advance agreement procedure used by DOD. It accomplishes several important objectives:

- It enables and requires contractors to plan IR&D programs in advance of expenditures, knowing approximately how many dollars will be recoverable.
- It clarifies the scope and type of effort considered applicable, thus reducing subsequent audit problems.
- It allows DOD to negotiate a reasonable dollar ceiling with the contractors before costs are incurred, so as to exercise a dollar control over a substantial portion of IR&D costs.

Advance agreements are carried out through the tri-service negotiation committee, with technical assistance from the Armed Services Research Specialists Committee.

Since it would be impossible for either committee to deal directly with the many thousands of contractors that have DOD contracts, both must confine their activities to the IR&D programs of about 110 defense-oriented plants which represent approximately 55 different companies. We have generally been able to negotiate agreements with major contractors, although there have been exceptions.

As the first step in negotiating an advance agreement, the contractor submits his proposed IR&D program to the Government for the ensuing year. It identifies areas of interest, outlines the objectives of each project, estimates the amount of money to be spent, and provides the background of key scientific personnel who will be engaged in the work. The proposal is reviewed by Army, Navy, Air Force and NASA laboratory personnel under the guidance of the Armed Services Research Specialists Committee. In addition to a technical review of the projects, the soundness of the planning is evaluated, and improvements that appear desirable in the contractor's program are identified and described.

In the process of establishing a suitable figure of allowable expenditures, the negotiator uses the technical evaluation as well as other kinds of business inputs. During the process, those projects that are not related to the functions and operations of the DOD, or that are out of consonance with public policy, are eliminated. Sharing arrangements and ceilings are also negotiated in order to establish maximum amounts chargeable to government contracts.

Since advance agreements are renewed each year, the negotiator reviews the past performance of the contractor against his previous year's plan. This is also used as input in establishing the level of support.

As a result of sharing arrangements, ceiling limitations and allocations to non-government business, the Government ultimately pays only a part of the contractor's total cost. For example, the aggregate of IR&D programs on which contractors had *advance agreements* for 1968 was $685 million. Of this amount, the committee identified $518 million as that considered reasonable by the Government, of which $299 million was DOD's share.

* * * * *

Bid and Proposal

Bids or proposals are offers to the customer which are submitted upon the customer's request or on an unsolicited basis. Since much of the equipment that DOD buys is highly sophisticated, the technical portion of proposals is quite significant, and the effort necessary to develop and prepare it is a major portion of proposal cost.

DOD has traditionally recognized the advantages of competition in terms of better products at lower cost and has, therefore, encouraged more than a single bid or proposal, wherever possible. However, since only one award is normally made, a given contractor will win only a fraction of the contracts on which he proposes. The more competitive the product area, the lower the rate of contract capture. The cost of all proposal effort, therefore, both successful and unsuccessful, must be recovered in the price of the contracts won, whether commercial or government, if the contractor is to continue in business. Recovery of these costs is through overhead charge; therefore, each customer of a company shares this expense in the cost of the product he buys.

In summary, then, we follow the concept that the costs of bid and proposal are legitimate and normal in the process of doing business. Contrary to some impressions, the DOD has no "pot of money" set aside for bid-and-proposal costs. We have no contracts or grants for this kind of work; it is a part of contractor overhead and is shared by all customers when they contract for either development or production work. When a contractor does not have a current DOD contract, the costs of bid and proposal cannot be recovered from the DOD.

Other Technical Effort. I should also like to comment on something that has come to be known as other technical effort (OTE). It refers to miscellaneous technical costs that are incurred by a contractor in the operation of his facility, but which are not classified in his accounting records as either IR&D or bid and proposal. We recently became concerned about the relationship between these kinds of costs and IR&D and bid and proposal. We felt that some contractors were classifying certain efforts in accounts other than IR&D or bid and proposal when they should more properly have placed, at least some of them, in the IR&D or bid-and-proposal category. We, therefore, requested an audit of the overhead accounts of several major contractors to determine what types of effort could be found that were technical in nature, but which were not included in IR&D or bid-and-proposal accounts. These were then grouped together under the category of OTE. OTE reports have been prepared and submitted for several years, so we have had the opportunity to look at a good cross section of the types of technical effort included. As

a result, we have found some efforts that relate to design and development of new products which, we have concluded, should be reclassified under the category of either IR&D or bid and proposal. Examples of these are feasibility and capability studies undertaken to determine whether current technology or resident technological capability is adequate to support the design and development of a new equipment or weapon system. Other examples are preproposal effort, predesign studies, and technical overhead.

Other efforts were found that did not belong in the IR&D or bid-and-proposal category, *e.g.*, charges for contractor technical personnel for the maintenance of complex test equipment, and engineering support of sales and marketing efforts. Such were clearly not of a research and development nature, since they add nothing to the store of technical knowledge and do not result in new or improved products. When our efforts on reclassification are complete, all effort now classified as OTE will be reclassified as IR&D or bid and proposal, or assigned to another overhead cost category that is more appropriate.

Changes Necessary. As a result of our experience with IR&D, it became evident to us several years ago that clarification and policy changes were needed. This included a need to better define IR&D, to recognize its relationship to both bid and proposal effort and other contractor technical effort that is independent in nature, and to establish a more objective and uniform approach to determining a "reasonable" allowance for these costs. . . .

Determination of "reasonable costs" in these areas was the major problem in formulating the proposed DOD policy. Based on the continuing belief that contractors should recover certain of their costs in these areas, DOD developed a proposed policy in December 1968 which was reviewed and approved by the Deputy Secretary of Defense. It is summarized as follows:

- IR&D and bid and proposal are so intimately related and so interdependent that actions taken should be equally applicable to both.
- The amount of IR&D and bid-and-proposal costs to be accepted by the Government would be determined by a formula that uses a company's historical use of IR&D or bid-and-proposal costs and sales dollars. The formula that was recommended and approved was:

For each company, annually compute the ratio of incurred IR&D or bid-and-proposal costs to sales for each of the preceding three years. Select the two highest annual ratios. Average them. This average ratio, times the sales for the current or projected year (dependent upon when the formula was applied) would establish the dollar amount considered reasonable. To prevent abnormal sales (either up or down) from providing an unreasonable result, a "ceiling" (120 percent) and a "floor" (80 percent) would also be established as a limit to a formula answer.

- Either the Government or industry could appeal the allowance produced by the formula in extraordinary situations.
- In view of the relationship of IR&D and bid-and-proposal efforts, contractors would be permitted to offset ceilings independently established for IR&D and for bid and proposal by reducing one and increasing the other by a like amount.
- IR&D and bid-and-proposal costs would be burdened with overhead in the same manner as a contracted project, except that general and administrative (G&A) costs would not be included.

Also, the definition of the term "IR&D" was expanded to cover, in addition to basic and applied research and development, that work which is generally referred to as a system concept formulation study and/or which comprises a specific IR&D effort directed to the identification of a desirable new system, equipment, or component, or desirable modifications and improvements to existing systems, equipments, or components. Bid-and-proposal costs were also further defined to include costs of preparing, submitting and supporting, to the date of contract award, bids and proposals. While this decision was reached well over a year ago, the General Accounting Office's concern over our approach and subsequent Congressional interest in this subject have caused us to withhold implementation. Before I outline our current proposed action, let us examine several issues which are of present concern to both the Congress and the DOD. . . .

Other Major Issues

IR&D Budget Line-Item Control.

I have been asked on a number of occasions why these costs can't be made a line item in the budget. . . . We see significant problems in planning budgets and operating under the resulting appropriations if line-item controls are instituted for IR&D and bid and proposal. Management of such a system would require a complex maze of administrative procedures of doubtful effectiveness. . . .

Budget Planning. It should be recognized that IR&D and bid-and-proposal costs are very different from line items which presently appear in the budget projects of the research, development, test and evaluation (RDT&E) and production appropriations. At present, budget line items relate to specific products and equipment which are required by the DOD. An IR&D/bid-and-proposal line item would relate to each of these items subsequently placed on a contract with one or several contractors.

If line-item controls were directed, the question would be how to establish the amount needed for a line item. It would not be feasible to ask contractors how much IR&D and bid-and-proposal cost they propose against line items on a proposed new budget, because at that time even they would not know whether or not they would bid on these future projects.

The need for IR&D and bid and proposal funding varies considerably from contractor to contractor depending upon his product line, his position in industry as a designer or copier, the need for new business, or the number of proposals the Government may request in any one year. Moreover, a particular contractor's requirements may vary appreciably from year to year. This is especially true of the smaller contractors.

A major difficulty would also arise

in the treatment of subcontractors. . . . On a large program, several hundred subcontractors would receive contracts from the prime contractor. These, in turn, generate additional tiers of subcontractors, each such contract being awarded under a different purchasing system.

The composition of a prime contractor's subcontract structure changes frequently over the span of a major program. This would make it impossible to use the same planning factors from year to year at the prime contract level.

Even if such a control were feasible for prime contractors on major weapons programs, such an arrangement would be infinitely more complex in planning the IR&D and bid-and-proposal costs associated with the thousands of lesser items bought under the RDT&E and production appropriations of the services. Not only would we be dealing with a greater number of items, but with a case where the prime contractors number about 22,000. Here, too, the problem of subcontracts arises.

We conclude that the administrative problem of establishing a budget line item is of such magnitude that we see no practical way to accomplish it except to arbitrarily use a percentage of the procurement budget. Such a computation, unsupported by rationale based either on industry needs or DOD benefits, is completely contrary to the policy governing the annual planning for defense expenditures.

Operating Difficulties in Negotiating New Contracts. We anticipate difficulties in negotiating new contracts if line-item controls are established. IR&D and bid-and-proposal costs are included in the overhead costs of practically every contractor who negotiates a contract with the DOD. Each subcontractor who receives a contract from a prime includes IR&D and bid-and-proposal costs in his overhead. Thus, instead of placing an item on direct contract with one or two contractors, we would be faced with the task of trying to find some equitable, consistent procedure for spreading IR&D and bid and proposal over the thousands of contracts we and the prime contractors write during a given fiscal year.

* * * * *

Operating Difficulties in Settlement of Completed Contracts. We anticipate great administrative complexity in negotiating annual overhead recovery rates for use in settlement of completed contracts. The reason is that line-item control amounts would vary from year to year. We anticipate that this would lead to different limitations by fiscal year. At any one time, the contractor might be operating under appropriations for three or more fiscal years. The allocation from the contractor's accounting pools to individual fiscal years' funding would be cumbersome and expensive, to say the least.

Bid-and-Proposal Line-Item Control. The problems of line-item controls are perhaps even more serious in the case of bid-and-proposal costs. The Government establishes the scope of work required in response to its requests for proposal. The Government issues these requests and selects prospective bidders. The Government defines, in considerable detail, how a proposal should be formulated, and determines how many projects it is ready to start in a particular time period. Thus, the number and cost of bids and proposals fluctuates greatly as a consequence of government action. The policy of fostering competition would be gravely challenged by line-item control on bid-and-proposal costs. Such control would pose problems in selecting contractors to bid and in limiting contractors' expenditures in bid preparation. . . .

We also consider line-item control of IR&D and bidding and proposal administratively infeasible for the foregoing reasons.

Relationship of IR&D to Contract Research and Development.

The use of contract research and development has been suggested as the vehicle with which to accomplish the current IR&D mission. Even though the primary purpose of contract research and development is to pursue new concepts in technology or system feasibility, its use in this expanded role would remove most of the advantages that make IR&D desirable [as previously explained in this statement].

We believe that the current contract research and development programs of the DOD represent a very good choice from among a much larger number of possible candidates. Choosing them is difficult, funds are limited, and the number of needs and of possible solutions is large, and proper management necessitates that the possibility of error be considered.

* * * * *

IR&D on the national level is that small percentage (about 4 percent) of the DOD contract research and development budget which is centrally controlled with respect to funding and general subject area only, but is not subject to the same detailed management reviews as the 96-percent balance of research and development expenditures. Thus, it is aimed at exploiting the independent, imaginative, original and creative thinking of our contractors in anticipating DOD problems and decisions and, thus, to broaden the support base available to the DOD. Our view is that both private initiative and directed development are necessary, but at different times and in different places in the development cycle. The genius of the American industrial system is that it is geared to tap the creativity of all participants.

Comments on Senate Bill 3003

. . . I will attempt to summarize the thoughts on those concepts that we believe constitute the true intent of S. 3003 [a bill introduced in the Senate to provide more effective control over the expenditure of funds by DOD and NASA for IR&D and for other purposes].

First, the bill defines OTE to be a part of IR&D. We believe that the intent of this provision is to make certain that all research and development effort charged through overhead is identified in one proper cost category. We fully agree with this objective and, as I have already stated, we have developed redefinition of IR&D that will accomplish this.

Second, S. 3003 appears to require that no IR&D projects may be supported in whole or in part by the DOD and NASA, except where projects relate to, or augment, work on specific contracts, in which event costs of selected projects may be provided for in the contract. This requirement would, in our opinion, eliminate IR&D

by denying the independence which distinguishes it from contract research and development.

Third, S. 3003 would require defense contractors to submit technical details of all IR&D projects to DOD for review and inclusion in a government-wide data bank. We concur in this as a concept, except that to be administratively practicable we believe such a plan must be proved cost-effective and should be limited to major defense contractors.

Fourth, with respect to bid and proposal, S. 3003 would limit reimbursement to those bid-and-proposal projects which are applicable to the program of the agency concerned. The apparent intent here is to ensure that DOD reimburses contractors only for bids and proposals submitted to DOD. In our opinion, such a restriction would not reduce the cost of bid and proposal, but would result in a major increase in administrative effort on the part of DOD and the defense contractors involved. Present accounting procedures put bid-and-proposal costs into overhead with allocation to all current business.

Fifth, S. 3003 would limit reimbursement of bid-and-proposal costs to 1 percent of the direct material and labor costs on DOD contracts. In our opinion, bid-and-proposal costs have no significant relationship to direct material and labor, and such a base should not be used as a measure of reasonableness. Moreover, we estimate that the 1 percent limitation represents only about one-half of the bid-and-proposal expenses currently being incurred by defense contractors. Such a restriction would sharply curtail the amount of competition we could expect on our procurement programs.

DOD Proposed Plan

As a result, we have concluded that the type of dollar and technical control and review that will in the long run best satisfy the concerns of the Congress and the General Accounting Office, and provide the most satisfactory solution to the many complex problems inherent in IR&D and bid and proposal, can be achieved within the existing DOD administrative framework and that, therefore, futher legislation is not necessary. In fact, such legislation could be detrimental to both the Government and industry and, consequently, would not be in the best interests of the nation; it could result in more costly effort that might be of less benefit.

We have just completed a thorough and detailed review of the whole area of IR&D and bid and proposal management and control. We have looked at changes that could increase control without removing or unduly restricting the features of flexibility and inventiveness upon which the system depends for its value. We have selected a plan, now approved by the Deputy Secretary of Defense, that makes use of both the negotiated advance agreements and the DOD-developed formula. We feel these will satisfy both congressional concerns and our own, while keeping alive the vital independent nature of this work. The five elements of this approach are:

- Use individually negotiated advance agreements for the control and reimbursement of these costs for approximately 100 of the larger defense contractors. This will require that we increase the number of contractors with which we negotiate advance agreements by a factor of almost two. Such agreements, after a formalized detailed technical review of the IR&D program, will establish a separate dollar ceiling for the DOD's reimbursement of each of these costs, but will allow the contractor to combine the individual amounts into a single pool if he chooses. We will require that contractor burden these costs as he would for a contract, except that general and administrative costs would not be added. The requirement to negotiate an advance agreement will be enforced by automatically establishing a low threshold for recovery of costs where no advance agreement exists.
- Strengthen technical review and evaluation of contractor IR&D programs, as currently established under DOD Instruction 4105.52. Establish uniform review and evaluation procedures to be used throughout the DOD. The system will require review of a contractor's individual IR&D projects, and will take both his accomplishments and his proposed plan into consideration.
- A data bank will be established to provide a centralized body of IR&D project cost and technical information. This information will be available to the government technical community at large.
- Use the DOD-developed formula for control and determination of reasonableness of costs for the remaining large number of smaller companies who recover IR&D and bid-and-proposal costs. This will provide a workable system that can be uniformly applied—one that will assure results that can be easily monitored and adjusted as needed.
- The military departments will increase as necessary the support and resources needed to effectively perform the required IR&D technical reviews and evaluations.

Provided that the Congress does not pass legislation that would require different action on the part of DOD, we plan to move toward the early and orderly implementation of this plan.

Pratt and Whitney To Develop F-14, F-15 Engine

The Air Force and Navy have announced the selection of Pratt and Whitney Division of the United Aircraft Corp., West Palm Beach, Fla., as the developer and producer of the Navy F–14B and Air Force F–15 engines.

A first buy of 90 engines will be to support initial test aircraft for both services, at a target price of $448,162,600. Development and options for production of engines are scheduled through 1975, with additional options for two years production.

The F–14B and F–15 engines will be high performance, afterburning turbofans, based on the technology level demonstrated by the lift/cruise, advance turbine engine gas generator, and the B–1 engine development programs. Both will be in the 20,000- to 30,000-pound thrust class, having common gas generators, but will differ in the size of the fans, afterburners and thrust levels.

Executive service for the engine program is the Air Force.

ABOUT PEOPLE

)EPARTMENT OF DEFENSE

)avid O. Cooke is the new Princi- Dep. Asst. Secretary of Defense dministration).

'oseph J. Liebling has been desig- ed Dep. Asst. Secretary, Security icy, Office of the Asst. Secretary Defense (Administration).

lear Adm. Emmett P. Bonner, N, has been named as Senior Navy mber, Weapons Systems Evalua- 1 Group, Office of Dir., Defense Re- rch and Engineering.

Brig. Gen. Daniel "Chappie" James USAF, is the new Dep. Asst. Sec- ary of Defense (Public Affairs).

Jew assignments announced by ., Defense Supply Agency (DSA), neron Station, Alexandria, Va., in- le: Maj. Gen. Roland B. Anderson, A, is now Executive Dir., Supply rations, Hq., DSA; and Rear m. Grover C. Heffner, SC, USN, replaced Maj. Gen. Emmett M. ly Jr., USAF, as Commander, De- se Construction Supply Center, umbus, Ohio. Maj. Gen. Tally has red.

Brig. Gen. Herbert A Schulke, Jr., A, has assumed duty as Dep. Dir., rations, Defense Communications ency, Arlington, Va.

:PARTMENT OF THE ARMY

)avid H. Ward is now Dep. Under retary of the Army (International airs), succeeding James V. Siena.

Maj. Gen. Edward P. Smith is the / Dir. of Doctrine and Systems, ce of the Asst. Chief of Staff for ce Development, Hq., Dept. of the ny.

Maj. Gen. Edward H. de Saussure has succeeded Maj. Gen. H. G. visson as Commander, White ids Missile Range, N.M. Maj. Gen. visson has retired.

Brig Gen. James W. Gunn has as- ned duties as Dir. of Management, Review and Analysis, Office of the Comptroller of the Army.

The Office of the Chief of Research and Development has announced the following assignments: Brig Gen. George Sammet Jr., Dir. of Plans and Programs; and Col. George A. Lutz, Dep. Dir. of Developments.

Brig. Gen. Otis E. Winn, USAF, has been appointed Asst. Commander, Military Traffic Management and Terminal Service (MTMTS), Washington, D.C. Also at MTMTS, Col. James H. O'Brien, USA, has been made Chief, Office of Public Affairs.

Col. Joe B. Lamb has assumed the duties of Dir. of Materiel, Army Combat Developments Command, Ft. Belvoir, Va.

Col George E. Rippey is the new Dir. of Communications Engineering, Army Strategic Communications Command, Ft. Huachuca, Ariz. Assuming Col. Rippey's former duties as Commander, Army Satellite Communications Agency, Ft. Monmouth, N.J., is Col. Leland D. Wamsted.

DEPARTMENT OF THE NAVY

Rear Adm. Parker B. Armstrong has been assigned as Commander, Antisubmarine Warfare Systems Project Office, Naval Material Command, Washington, D.C.

Rear Adm. John G. Dillon is the new Commander, Northern Div., Naval Facilities Engineering Command, Philadelphia, Pa. The Western Div., Naval Facilities Engineering Command, San Francisco, Calif., also has a new commander, Rear Adm. Henry J. Johnson.

Rear Adm. William H. House has been named a Dir., Strike Warfare Div., and CVAN Program Coordinator, Office of the Dep. Chief of Naval Operation (Fleet Operations and Readiness).

Rear Adm. John P. Weinel has been appointed Asst. Dep. Chief of Naval Operations (Plans and Policy).

DEPARTMENT OF THE AIR FORCE

The following have been confirmed as lieutenant generals: Otto J. Glasser, Dep. Chief of Staff, Research and Development, Hq., USAF; and Russell E. Dougherty, Dep. Chief of Staff, Plans and Operations, Hq., USAF.

Maj. Gen. Donavon F. Smith has assumed duties as Dir. of Operational Requirements and Development Plans, Office of the Dep. Chief of Staff, Research and Development, Hq., USAF.

The following brigadier generals have been confirmed to the rank of major general: Jones E. Bolt, Dep. Dir. of Operations for Strike Forces, Office of the Dep. Chief of Staff, Plans and Operations, Hq., USAF; Maurice F. Casey, Dir. of Transportation, Office of the Dep. Chief of Staff, Systems and Logistics, Hq., USAF; William S. Chairsell, Vice Commander, Armament Development and Test Center, AFSC, Eglin AFB, Fla.; Henry L. Hogan III, Dir., Office of Information, Office of the Secretary of the Air Force; and Harold C. Teubner, Dep. Chief of Staff, Comptroller, AFSC, Washington, D.C.

The following brigadier generals have been nominated for promotion to major general: Leslie W. Bray Jr., Dir., Doctrine, Concepts and Objectives, Office of the Dep. Chief of Staff, Plans and Operations, Hq., USAF; Ernest T. Cragg, Dep. Dir. of Aerospace Programs, Office of the Dep. Chief of Staff, Programs and Resources, Hq., USAF; and Roger K. Rhodarmer, Dir. of Reconnaissance and Electronic Warfare, Office of the Dep. Chief of Staff, Research and Development, Hq., USAF.

Brig. Gen. Douglas T. Nelson is the new Dep. System Program Dir. for the B-1, Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio.

Status of Funds Quarterly Report

Outlays

Second Quarter, Fiscal Year 1970

(Thousands of Dollars)

Department of Defense

Department of Defense	Outlays				Unpaid obligations	
	Oct. 1969	Nov. 1969	Dec. 1969	Cum thru Dec. 1969	At start of year	As of 31 Dec. 1969
Military Personnel						
Active forces	1,896,628	1,798,844	1,806,113	10,781,951	592,306	785,776
Reserve forces	85,345	71,724	75,122	554,003	152,294	143,097
Retired pay	226,822	237,198	238,993	1,362,196	6,354	8,215
Undistributed	8,238	−326	369	−40,790	—	40,790
Total—Military Personnel	2,217,032	2,047,441	2,120,597	12,607,360	750,955	927,878
Operation and Maintenance	1,878,263	1,874,512	1,734,884	10,863,435	3,924,991	4,166,150
Procurement						
Aircraft	675,661	695,471	675,504	4,109,282	7,701,062	5,908,821
Missiles	289,654	214,947	284,693	1,405,503	2,516,998	2,866,625
Ships	184,397	149,590	172,598	1,033,238	3,085,253	3,103,039
Tracked combat vehicles	26,087	27,319	26,610	186,677	454,414	414,806
Ordnance, vehicles and related equipment	595,571	384,664	399,148	2,465,376	5,690,581	5,434,712
Electronics and communications	107,211	90,180	98,054	545,308	1,621,409	1,538,600
Other procurement	126,710	123,400	204,904	967,582	2,016,381	1,918,931
Undistributed	57,715	2,850	28,939	431,685	128,925	−176,158
Total—Procurement	2,063,007	1,688,419	1,840,394	11,094,654	23,215,023	21,008,877
Research, Development, Test, and Evaluation						
Military sciences	83,998	67,943	67,741	432,945	712,919	690,481
Aircraft	79,174	123,689	114,916	613,437	681,935	682,059
Missiles	223,616	152,482	217,354	1,135,652	1,077,605	1,356,525
Astronautics	67,651	68,281	64,896	434,617	462,428	425,432
Ships	31,982	21,918	35,170	171,625	284,836	394,815
Ordnance, vehicles and related equipment	28,339	24,788	26,546	160,512	229,411	212,754
Other equipment	83,577	74,813	79,225	463,862	501,780	533,855
Program-wide management and support	36,912	47,708	27,283	217,931	282,019	239,879
Undistributed	−6,409	−6,915	4,816	40,438	38,151	−8,131
Total—Research, Development, Test, and Evaluation	628,838	574,709	637,896	3,671,019	4,261,084	4,467,667
Military Construction	123,026	86,801	105,213	665,326	1,806,093	1,491,490
Family Housing	57,583	51,175	53,344	314,470	256,946	193,489
Civil Defense	5,919	5,348	7,083	39,663	55,255	45,577
Other—Special Foreign Currency Program	46	37	89	280	363	467
Revolving and Management Funds	16,182	−272,734	99,226	−145,069	6,615,240	6,367,728
Applicable Receipts	−11,459	−3,997	−13,154	−59,046	—	—
Subtotal—Federal Funds	6,978,437	6,051,713	6,585,521	39,052,093	40,885,950	38,669,323
Trust Funds	5,785	−690	−1,189	3,832	4,821	4,738
Interfund Transactions	−2,599	242	−252	−2,612	—	—
Total—Military Functions	6,981,623	6,051,265	6,584,079	39,053,312	40,890,771	38,674,061
Military Assistance						
Federal Funds	61,525	64,559	47,578	296,737	1,562,839	1,324,925
Trust Funds	9,740	7,003	−15,256	−5,254	227,015	189,874
Total—Military Assistance	71,266	71,560	32,323	291,483	1,789,854	1,514,798
TOTAL—DEPARTMENT OF DEFENSE	7,052,888	6,122,827	6,616,402	39,344,796	42,680,624	40,188,860

Department of the Army

Department of the Army	Oct. 1969	Nov. 1969	Dec. 1969	Cum thru Dec. 1969	At start of year	As of 31 Dec. 1969
Military Personnel						
Active forces	767,332	694,670	754,672	4,305,103	213,798	346,538
Reserve forces	54,081	44,615	49,121	370,859	115,658	104,039
Undistributed	6,203	12,864	−3,777	−54,650	—	54,650
Total—Military Personnel	827,616	752,149	800,016	4,621,312	329,457	505,227
Operation and Maintenance	665,794	681,277	678,773	3,868,060	1,337,848	1,354,489
Procurement						
Aircraft	68,959	74,041	81,144	452,546	1,063,782	790,108
Missiles	59,435	53,101	62,918	327,107	848,404	1,076,661
Tracked combat vehicles	26,186	20,306	29,809	127,341	431,068	384,128
Ordnance, vehicles and related equipment	180,195	179,406	221,396	1,101,041	2,965,280	2,809,542
Electronics and communications	38,678	32,262	33,844	179,075	581,475	483,120
Other procurement	39,222	38,552	31,653	201,297	682,896	592,073
Undistributed	47,962	11,441	20,878	401,095	39,722	−231,199
Total—Procurement	460,637	409,109	481,732	2,789,502	6,612,627	5,904,428
Research, Development, Test, and Evaluation						
Military sciences	10,340	11,181	14,098	68,955	96,888	110,484
Aircraft	5,189	8,008	5,578	33,877	89,782	88,939
Missiles	80,309	53,671	84,798	408,361	419,831	589,040
Astronautics	606	845	575	3,291	3,813	4,180
Ordnance, vehicles and related equipment	14,503	12,763	12,980	81,554	115,667	112,477
Other equipment	35,907	30,012	28,013	170,026	196,095	195,056
Program-wide management and support	4,863	3,916	4,880	29,018	32,104	33,342
Undistributed	−5,559	13,212	−13,263	24,970	13,651	−14,732
Total—Research, Development, Test, and Evaluation	146,157	133,109	137,660	820,053	967,831	1,118,786
Military Construction	46,535	44,412	30,978	245,782	776,104	684,075
Revolving and Management Funds	−10,469	−17,593	19,436	120,447	1,856,891	1,628,478
Applicable Receipts	−9,137	1,142	−2,608	−23,977	—	—
Subtotal—Federal Funds	2,127,132	2,003,606	2,140,988	12,441,179	11,880,257	11,195,488
Trust Funds	5,505	−1,121	−1,370	2,773	89	−198
TOTAL—DEPARTMENT OF ARMY	2,132,637	2,002,485	2,139,619	12,443,953	11,880,346	11,195,289

Department of the Navy

	Outlays: Oct. 1969	Outlays: Nov. 1969	Outlays: Dec. 1969	Outlays: Cum thru Dec. 1969	Unpaid obligations: At start of year	Unpaid obligations: As of 31 Dec. 1969
Military Personnel						
Active forces	588,690	508,344	525,192	3,185,627	168,734	218,989
Reserve forces	15,040	12,539	12,645	87,381	23,320	25,322
Undistributed	−1,746	−3,312	1,708	16,271	—	−16,271
Total—Military Personnel	601,984	517,571	539,545	3,289,279	192,054	228,040
Operation and Maintenance	503,411	441,993	398,634	2,881,549	1,537,613	1,699,384
Procurement						
Aircraft	226,574	182,571	202,621	1,227,073	2,861,615	2,223,988
Missiles	68,285	45,531	46,981	320,623	703,716	759,485
Ships	184,397	149,590	172,598	1,033,238	3,085,253	3,103,039
Tracked combat vehicles	−99	7,013	−3,289	9,336	23,346	30,678
Ordnance, vehicles and related equipment	183,010	107,347	93,997	710,701	1,536,287	1,351,925
Electronics and communications	34,225	32,265	30,398	195,755	576,715	564,248
Other procurement	70,311	66,592	94,973	479,108	1,194,841	1,182,535
Undistributed	522	1,742	−58	16,877	71,369	50,416
Total—Procurement	767,225	592,649	638,223	3,992,712	10,053,142	9,266,265
Research, Development, Test, & Evaluation						
Military sciences	16,150	11,089	13,071	82,702	129,992	120,607
Aircraft	37,914	39,788	54,275	250,947	253,929	366,495
Missiles	53,931	33,543	42,846	274,194	291,240	302,960
Astronautics	1,653	1,115	1,796	8,958	15,598	18,104
Ships	31,982	21,918	35,170	171,625	284,836	334,815
Ordnance, vehicles and related equipment	13,836	12,025	13,566	78,958	113,744	100,277
Other equipment	15,889	12,970	17,253	86,223	77,139	101,178
Program-wide management and support	8,209	15,802	3,114	43,194	219,464	163,782
Undistributed	−82	−5,689	6,841	4,545	14,446	8,098
Total—Research, Development, Test, & Evaluation	179,483	142,560	187,932	1,001,346	1,400,888	1,576,311
Military Construction	33,302	15,445	37,374	191,567	616,207	562,758
Revolving and Management Funds	−14,103	−61,990	99,194	−37,172	2,199,935	2,183,274
Applicable receipts	−669	−3,823	−7,647	−21,706	—	—
Subtotal—Federal Funds	2,070,634	1,644,403	1,893,256	11,297,575	15,999,338	15,516,031
Trust Funds	608	−56	879	2,971	277	181
Interfund Transactions	−2,599	242	−252	−2,612	—	—
TOTAL—DEPARTMENT OF THE NAVY	2,068,642	1,644,590	1,893,883	11,297,934	15,999,615	15,516,211

Department of the Air Force

Military Personnel						
Active forces	540,606	535,830	526,249	3,241,221	209,774	170,249
Reserve forces	16,224	14,570	13,356	95,763	13,316	13,736
Undistributed	3,781	−9,878	2,438	−2,411	—	—
Total—Military Personnel	560,611	540,522	542,043	3,334,573	223,090	186,896
Operation and Maintenance	611,793	665,236	505,504	3,548,275	953,240	981,156
Procurement						
Aircraft	380,128	438,859	391,739	2,420,663	3,775,665	2,894,230
Missiles	161,934	116,315	124,784	757,773	964,878	1,030,529
Ordnance, vehicles and related equipment	232,274	97,760	83,711	653,188	1,188,875	1,278,169
Electronics and communications	33,987	24,917	33,527	166,769	455,843	486,113
Other procurement	5,818	10,850	68,944	250,667	95,195	96,295
Undistributed	9,304	−10,311	7,813	13,371	17,834	4,967
Total—Procurement	823,395	678,390	710,469	4,271,432	6,498,290	5,785,303
Research, Development, Test, & Evaluation						
Military sciences	15,109	13,570	9,173	68,461	90,842	90,921
Aircraft	36,071	75,893	55,063	328,613	338,224	226,625
Missiles	89,376	66,268	89,710	453,097	366,534	464,575
Astronautics	65,392	66,821	62,524	422,967	433,017	403,148
Other equipment	31,781	31,831	33,959	207,613	228,546	177,626
Program-wide management and support	23,840	27,990	19,239	145,719	30,451	42,705
Undistributed	−708	−14,438	11,238	10,923	10,054	−1,497
Total—Research, Development, Test, & Evaluation	260,800	266,936	280,905	1,636,793	1,497,668	1,404,103
Military Construction	41,722	26,251	36,114	221,824	393,810	229,127
Revolving and Management Funds	21,410	−168,201	−24,614	−228,069	1,276,941	1,494,260
Applicable Receipts	−1,652	−1,341	−2,897	−13,350	—	—
Subtotal—Federal Funds	2,318,078	2,007,821	2,107,525	12,771,479	10,843,039	10,080,345
Trust Funds	−328	487	−698	−1,912	4,455	4,751
TOTAL—DEPARTMENT OF THE AIR FORCE	2,317,751	2,008,307	2,106,827	12,769,567	10,847,494	10,085,069

Defense Agencies/Office of the Secretary of Defense	Outlays				Unpaid obligations	
	Oct. 1969	Nov. 1969	Dec. 1969	Cum thru Dec. 1969	At start of year	As of 31 Dec. 1969
Military Personnel						
Retired Pay	226,822	237,198	238,993	1,362,196	6,354	8,215
Operation and Maintenance	97,266	86,006	96,971	565,550	96,790	131,121
Procurement						
Ordnance, vehicles and related equipment	92	151	44	446	139	76
Electronics and communications	371	736	285	3,709	7,376	5,119
Other procurement	11,359	7,406	9,334	36,510	43,449	48,028
Undistributed	−73	−22	306	342	—	−342
Total—Procurement	11,748	8,272	9,970	41,008	50,964	52,881
Research, Development, Test, & Evaluation						
Military sciences	42,399	32,103	31,399	212,827	395,197	368,469
Military Construction	1,467	693	748	6,154	19,972	15,529
Family Housing	57,583	51,175	53,344	314,470	256,946	193,488
Other—Special Foreign Currency Program	46	37	89	280	363	467
Revolving and Management Funds	19,343	−24,949	5,208	−276	1,281,474	1,061,718
Applicable Receipts	—	−2	−4	−13	—	—
Subtotal—Federal Funds	456,673	390,535	436,720	2,502,198	2,108,061	1,831,888
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	456,673	390,535	436,720	2,502,198	2,108,061	1,831,888

Office of Civil Defense

Civil Defense	5,919	5,848	7,033	39,663	55,255	45,577

Obligations

Department of Defense	Available for obligation	Obligations			Cum thru 31 Dec. 1969	Unobligated balance 31 Dec. 1969
		Oct. 1969	Nov. 1969	Dec. 1969		
Military Personnel						
Active forces	20,034,400	1,832,331	1,790,560	1,779,844	11,021,620	9,012,780
Reserve forces	1,020,605	73,285	73,732	71,399	542,968	477,637
Total—Military Personnel	21,055,005	1,905,616	1,864,292	1,851,244	11,564,589	9,490,416
Retired Military Personnel						
Retired Pay, Defense	2,735,000	226,751	237,330	239,417	1,363,843	1,371,157
Operation and Maintenance	23,104,267	2,288,010	1,737,545	1,729,806	12,134,993	10,969,275
Procurement						
Aircraft	10,101,413	479,664	326,817	574,685	2,573,397	7,528,016
Missiles	4,098,622	332,669	206,613	585,488	1,788,532	2,310,090
Ships	5,011,431	215,560	318,560	164,523	1,108,509	3,902,922
Tracked combat vehicles & other weapons	360,305	10,480	21,616	31,122	146,532	213,773
Ordnance, vehicles and related equipment	6,652,077	813,190	401,541	369,691	3,166,405	3,486,572
Electronics and communications	2,046,162	109,362	83,973	115,217	523,045	1,523,117
Other procurement	3,059,400	116,585	158,138	169,678	1,029,144	2,030,257
Undistributed	−94,848	18	−953	−2,540	−4,302	−90,546
Total—Procurement	31,235,462	2,077,529	1,516,305	2,007,865	10,331,263	20,904,199
Research, Development, Test, & Evaluation						
Military sciences	1,014,164	90,056	65,462	59,445	446,574	567,572
Aircraft	1,698,703	43,225	74,218	29,955	621,155	1,068,548
Missiles	2,529,218	353,343	144,775	204,375	1,489,726	1,039,492
Astronautics	876,654	53,651	66,680	45,358	437,893	438,761
Ships	349,707	36,190	13,147	16,134	228,394	121,313
Ordnance, vehicles, & related equipment	339,692	8,286	9,754	13,348	147,749	191,943
Other equipment	1,187,670	68,443	53,978	63,791	509,556	678,114
Program-wide management & support	658,259	38,768	55,903	28,970	298,925	359,334
Emergency fund	75,000	—	—	—	—	75,000
Undistributed	−14,690	−1,040	341	−137	−1,851	−12,840
Total—Research, Development, Test & Evaluation	8,705,359	690,925	484,255	461,240	4,178,121	4,527,238
Military Construction	3,197,727	70,948	139,465	113,241	597,998	2,599,728
Family Housing	689,837	64,002	30,146	33,613	256,871	432,966
Civil Defense	74,096	3,482	3,750	6,806	30,318	43,778
Other—Special Foreign Currency	15,162	76	68	117	384	14,777
Revolving and Management Funds	22,884,192	1,878,146	1,628,560	1,440,886	11,087,108	11,797,027
Offsetting receipts	−134,665	−8,776	−8,553	−12,798	−58,707	−75,958
Subtotal—Federal funds	113,561,384	9,191,708	7,633,159	7,871,436	51,486,781	62,074,603
Trust funds	75,122	15,662	3,674	4,993	32,912	42,209
Interfund transactions	−7,200	−18	242	−252	−2,612	−4,588
Total—Military Functions	113,629,306	9,207,353	7,637,075	7,876,177	51,517,081	62,112,225
Military Assistance						
Federal funds	250,145	14,262	8,956	−4,964	140,418	109,727
Trust funds	1,861,811	4,314	−1,420	−16,737	−42,395	1,904,206
Total—Military Assistance	2,111,956	18,576	7,536	−21,701	98,023	2,013,933
TOTAL—DEPARTMENT OF DEFENSE	115,741,262	9,255,929	7,644,610	7,854,477	51,615,104	64,126,158

Department of the Army

Department of the Army	Available for obligation	Obligations			Cum thru 31 Dec. 1969	Unobligated balance 31 Dec. 1969
		Oct. 1969	Nov. 1969	Dec. 1969		
Military Personnel						
Active forces	8,229,000	734,103	719,462	734,561	4,501,687	8,727,318
Reserve forces	665,400	47,290	47,219	45,477	357,698	307,702
Total—Military Personnel	8,894,400	781,393	766,681	780,039	4,859,386	4,035,014
Operation and Maintenance	8,422,064	818,904	588,285	632,820	4,311,909	4,110,155
Procurement						
Aircraft	817,249	51,561	21,377	25,288	187,542	629,707
Missiles	977,190	110,720	28,058	323,157	568,175	409,015
Tracked combat vehicles	314,979	9,719	21,110	16,333	129,864	185,115
Ordnance, vehicles and related equipment	4,136,575	640,532	226,773	226,744	1,900,222	2,236,353
Electronics and communications	782,112	26,534	16,102	9,862	101,733	680,379
Other procurement	967,263	42,353	9,063	83,637	149,366	817,897
Undistributed	151,106	−966	−88	−1,016	−2,018	153,119
Total—Procurement	8,146,474	880,453	382,390	634,005	3,034,889	5,111,585
Research, Development, Test, & Evaluation						
Military sciences	191,102	13,055	10,424	11,441	100,787	90,315
Aircraft	152,719	4,351	11,615	5,957	35,821	116,898
Missiles	936,586	219,190	82,762	100,869	586,053	350,583
Astronautics	15,399	522	524	1,009	3,660	11,739
Ordnance, vehicles and related equipment	220,650	5,822	5,699	8,760	82,375	138,275
Other equipment	473,452	19,082	23,577	34,895	176,349	297,103
Program-wide management and support	67,762	5,362	4,847	4,080	32,103	35,660
Undistributed	−33,060	−63	98	140	−500	−32,560
Total—Research, Development, Test, & Evaluation	2,024,611	267,321	89,486	167,241	1,016,648	1,007,963
Military Construction	1,458,606	25,853	50,467	50,907	267,622	1,190,984
Revolving and Management Funds	6,085,603	409,823	361,618	374,168	2,573,840	3,511,763
Applicable receipts	−67,611	−4,601	−3,988	−2,565	−23,925	−43,686
Subtotal—Federal Funds	34,964,147	3,239,146	2,175,534	,2636,615	16,040,369	18,923,778
Trust Funds	32,409	6,860	72	1	10,332	22,077
TOTAL—DEPARTMENT OF THE ARMY	34,996,557	3,246,006	2,175,606	2,636,616	16,050,701	18,945,856

Department of the Navy

Military Personnel						
Active forces	5,940,100	562,544	526,869	506,955	3,258,285	2,681,815
Reserve forces	176,570	10,444	11,994	11,814	89,851	86,719
Total—Military Personnel	6,116,670	572,988	538,863	518,769	3,348,136	2,768,534
Operation and Maintenance	6,322,036	695,492	495,994	490,458	3,399,728	2,922,308
Procurement						
Aircraft	2,816,864	157,200	128,548	155,042	626,998	2,189,866
Missiles	1,044,079	47,502	183,372	27,361	393,819	650,760
Ships	5,011,431	215,560	318,560	164,529	1,108,509	3,902,922
Tracked combat vehicles	45,326	761	506	14,789	16,668	28,658
Ordnance, vehicles and related equipment	1,453,010	52,207	65,617	90,519	528,318	924,692
Electronics and communications	598,521	49,469	80,044	41,632	187,696	410,825
Other procurement	1,501,565	58,819	189,233	48,606	585,718	915,847
Undistributed	−631,404	816	−851	−1,521	−2,743	−628,661
Total—Procurement	11,839,890	581,895	815,028	540,949	3,444,480	8,394,910
Research, Development, Test, & Evaluation						
Military sciences	101,417	16,719	4,384	6,744	76,508	24,909
Aircraft	866,334	87,245	45,330	16,852	363,578	502,756
Missiles	544,914	87,877	21,362	56,722	294,571	250,343
Astronautics	25,328	1,087	3,618	1,371	11,514	13,809
Ships	349,707	36,190	13,147	16,134	228,394	121,313
Ordnance, vehicles and related equipment	119,042	2,464	4,055	4,588	65,374	53,668
Other equipment	276,438	30,877	13,066	13,615	171,368	105,070
Program-wide management and support	260,702	10,288	26,451	7,311	103,176	157,526
Undistributed	−5,327	−1,206	330	−259	−1,135	−4,192
Total—Research, Development, Test, & Evaluation	2,538,545	170,991	131,738	123,078	1,313,343	1,225,202
Military Construction	1,212,206	42,426	79,362	55,884	272,048	940,159
Revolving and Management Funds	8,252,987	655,263	556,877	560,292	3,887,108	4,365,879
Applicable Receipts	−37,696	−3,242	−3,331	−7,646	−21,704	−15,992
Subtotal—Federal Funds	36,244,138	2,715,810	2,614,035	2,290,733	15,643,139	20,600,999
Trust Funds	15,605	932	398	3,178	6,301	9,304
Interfund Transactions	−7,200	−18	242	−252	−2,612	−4,588
TOTAL—DEPARTMENT OF THE NAVY	36,252,543	2,716,724	2,614,674	2,293,658	15,646,827	20,605,716

Department of the Air Force

Department of the Air Force	Available for obligation	Obligations: Oct. 1969	Nov. 1969	Dec. 1969	Cum thru 31 Dec. 1969	Unobligated balance 31 Dec. 1969
Military Personnel						
Active forces	5,865,300	535,684	544,229	538,328	3,261,648	2,603,652
Reserve forces	178,635	15,551	14,519	14,108	95,419	83,216
Total—Military Personnel	6,043,935	551,235	558,748	552,436	3,357,067	2,686,868
Operation and Maintenance	7,202,948	660,440	562,755	507,443	3,801,486	3,401,462
Procurement						
Aircraft	6,467,300	270,903	176,892	394,355	1,758,857	4,708,443
Missiles	2,077,353	174,447	45,188	234,970	827,038	1,250,315
Ordnance, vehicles and related equipment	1,062,711	120,331	109,004	52,404	737,482	325,229
Electronics and communications	655,846	33,168	36,889	63,614	232,164	423,682
Other procurement	465,636	4,298	7,784	69,849	251,767	213,869
Undistributed	383,961	168	−13	−4	454	383,507
Total—Procurement	11,112,807	603,315	375,744	815,192	3,807,766	7,305,041
Research, Development, Test, & Evaluation						
Military sciences	178,842	15,297	9,880	9,653	80,365	98,477
Aircraft	670,650	1,629	17,273	7,146	221,756	448,894
Missiles	1,047,718	96,776	90,651	46,784	609,102	438,616
Astronautics	835,932	52,092	62,543	42,888	422,719	413,213
Other equipment	437,785	18,484	17,336	15,281	161,844	275,941
Program-wide management and support	329,794	23,118	24,605	17,579	163,646	166,148
Undistributed	23,697	229	−27	−18	−215	23,912
Total—Research, Development, Test, & Evaluation	3,524,418	207,628	222,257	189,314	1,659,216	1,865,202
Military Construction	463,505	2,585	9,624	6,207	56,619	406,887
Revolving and Management Funds	4,868,553	477,972	472,562	283,862	3,123,046	1,745,507
Offsetting Receipts	−29,323	−1,639	−1,332	−2,583	−13,043	−16,280
Subtotal—Federal Funds	33,186,844	2,501,537	2,200,358	2,301,871	15,792,157	17,394,687
Trust Funds	27,108	7,871	3,204	1,815	16,280	10,828
TOTAL—DEPARTMENT OF THE AIR FORCE	33,213,951	2,509,409	2,203,562	2,303,685	15,808,437	17,405,514

Defense Agencies/Office of the Secretary of Defense

Military Personnel						
Retired pay	2,735,000	226,751	237,330	239,417	1,363,843	1,371,157
Operation and Maintenance	1,157,219	108,175	90,510	99,085	621,870	535,349
Procurement						
Ordnance, vehicles and related equipment	681	60	147	24	383	298
Electronics and communications	9,683	191	988	109	1,452	8,231
Other procurement	124,937	11,614	2,058	17,586	42,293	82,641
Undistributed	1,489	—	—	—	—	1,489
Total—Procurement	136,790	11,866	3,143	17,719	44,128	92,662
Research, Development, Test, & Evaluation						
Military sciences	542,785	44,985	40,774	31,607	188,914	353,871
Emergency fund	75,000	—	—	—	—	75,000
Undistributed	—	—	—	—	—	—
Total—Research, Development, Test, & Evaluation	617,785	44,985	40,774	31,607	188,914	428,871
Military Construction	63,409	85	12	293	1,710	61,699
Family Housing	689,837	64,002	30,146	33,613	256,871	432,966
Other—Special Foreign Currency Program	15,162	76	63	116	384	14,778
Revolving and Management Funds	3,676,991	275,087	237,508	213,564	1,503,113	2,173,878
Offsetting Receipts	−35	706	−2	−4	−35	—
Subtotal—Federal Funds	9,092,158	731,732	639,484	635,411	3,980,798	5,111,361
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	9,092,158	731,732	639,484	635,411	3,980,798	5,111,361

Office of Civil Defense

Civil Defense	74,096	3,482	3,750	6,806	30,318	43,778

Military Assistance

Federal Funds	250,145	14,262	8,956	−4,964	140,418	109,727
Trust Funds	1,861,811	4,314	−1,420	−16,737	−42,395	1,904,206
TOTAL—MILITARY ASSISTANCE	2,111,956	18,576	7,536	−21,701	98,023	2,013,933

NOTE: All outlay amounts are on a net Treasury basis (gross payments less reimbursement collections), whereas obligations and unpaid obligations are on a gross basis (inclusive of reimbursable activity performed by components of DOD for each other). Therefore, unpaid obligations as of the end of the reporting month cannot be computed from other figures in this report.

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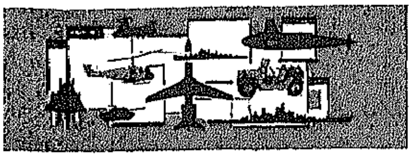

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over **'arded during the month of March** **70.**

DEFENSE SUPPLY AGENCY

—**Standard Oil Co.**, Louisville, Ky. $2,088,-688. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1258.

—**Varian Associates, Eimac Div.**, San Carlos, Calif. $1,318,296 (contract modification). 141,600 electron tubes, 7034/4X150A. Defense Electronics Supply Center, Dayton, Ohio. DSA 900-69-D-7811.

—The Defense Fuel Supply Center, Alexandria, Va., issued the following indefinite quantity contracts for fuel oil and gasoline:

  Gulf Oil Corp., Houston, Tex. $2,988,-871. DSA 600-70-D-1234.

  Esso Standard Oil Co., San Juan, P.R. $1,330,084. DSA 600-70-D-1232.

—**United Tractor and Equipment Co.**, Rockville, Md. $1,826,480. 358 warehouse tractors (4,000 pound capacity). Chesterton, Ind. Defense General Supply Center, Richmond, Va. DSA 400-70-C-4251.

—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts:

  Mobil Oil Corp., New York, N.Y. $4,-676,241. Fuel oil for the Army and Navy. DSA 600-70-D-1288.

  Gulf Oil Trading Co., Washington, D.C. $1,315,450. No. 6 fuel oil for the Navy. DSA 600-70-D-1282.

—**Texaco, Inc.**, Long Island City, N.Y. $1,-500,000. 750,000 barrels of No. 6 fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1156.

—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts:

  Lancer Clothing Corp., Gainesville, N.Y. $1,333,040. 30,400 pairs of flying coveralls for the Air Force. Land Manufacturing Co., Inc., Wichita, Kan. DSA 100-70-C-1632.

  Mason and Hughes, Inc., Philadelphia, Pa. $1,455,978. 85,000 pairs of Air Force flying coveralls. Allen Overall Co., Monroe, N.C. DSA 100-70-C-1633.

  Lion Uniform, Inc., Dayton, Ohio. $1,-181,832. 27,600 pairs of Air Force flying coveralls. Williamsburg, Ky. DSA 100-70-C-1631.

19—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for No. 6 fuel oil for the Navy:

  Atlantic Richfield Corp., Los Angeles, Calif. $3,793,000. DSA 600-70-D-1306.

  Shell Oil Co., New York, N.Y. $1,110,-000. DSA 600-70-D-1308.

20—**Bucyrus-Erie Co.**, Evansville, Ind. $1,987,-776. 23 crawler-mounted 40-ton shovel cranes. Erie, Pa. Defense Construction Supply Center, Columbus, Ohio. DSA-700-70-C-8985.

25—**DeRossi and Son Co.**, Vineland, N.J. $1,-616,000. 100,000 men's wool serge Army coats. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1659.

26—**Lester D. Lawson and Co.**, Long Beach, Calif. $2,613,290. 95,760 cases of ration supplement sundries packs. Boothe Packing Co., Modesto, Calif. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-70-C-S500.

—**Standard Oil Co. of Calif.**, San Francisco, Calif. $2,699,669. 18,450,201 gallons of gasoline and kerosene. Dutch Harbor, Alaska. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-C-1354.

27—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts:

  Refineria Panama, S.A., New York, N.Y. $3,885,000. 2,500,000 barrels Navy no. 6 fuel oil. Rep. of Panama. DSA 600-70-D-1455.

  Mobil Oil Corp., New York, N.Y. $1,-102,800. 600,000 barrels Navy no. 6 fuel oil. Balboa, Canal Zone. DSA 600-70-D-1454.

  Pittston Clinchfield Coal Sales Corp., New York, N.Y. $2,520,000. 240,000 net tons of bituminous coal for the Army. Clinchfield, Va. DSA 600-70-D-0186.

30—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts:

  General Foods Corp., White Plains, N.Y. $2,846,278. 4,404,640 units (800 grams) of instant rice for the Republic of Vietnam Air Force operational ration program. Dover, Del. DSA 13H-70-C-V100.

  Rivianna Foods, Inc., Houston, Tex. $1,-151,764. 1,867,700 units of instant rice for the RVNAF operational ration program. DSA 13H-70-C-V101.

—**United Tractor and Equipment Co.**, Rockville, Md. $1,284,830. 358 warehouse tractors, 4,000 pound capacity. Chesterton, Ind. Defense General Supply Center, Richmond, Va. DSA 400-70-C-4251.

31—**Ingersoll Rand Co.**, Cleveland, Ohio. $1,-424,408. 112 pneumatic tool and compressor units. Mocksville, N.C. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-9170.

—**American Oil Co.**, Chicago, Ill. $3,462,-931. 24,444,300 gallons of fuel oil and motor gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1072.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

DEPARTMENT OF THE ARMY

2—**Magnavox Co.**, Urbana, Ill. $1,030,965. Direction computers and memory units for M18 howitzer computers. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0487.

—**Universal Constructors, Inc.**, Albuquerque, N.M. $3,552,988. Construction of the south diversion channel on the Albuquerque Diversions Channel Project. Army Engineer District, Albuquerque, N.M. DA-CW47-70-C-0004.

—**General Electric Co.**, Portland, Ore. $1,-181,020. Three-phase power transformers (208,000 KVA) for the Dalles Dam Project, Ore. Pittsfield, Mass. Army Engineer District, Portland, Ore. DA-CW57-70-C-0084.

—**Whittaker Power System Corp.**, Primos, Pa. $3,578,949 (contract modification). 30 KW, 60 Hz generator sets. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-67-C-1425.

—**Barrett Intercommunication Products Corp.**, Brooklyn, N.Y. $2,448,997. TA-312/PT telephone sets. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-4104.

—**Philco-Ford Corp.**, Palo Alto, Calif. $13,-000,000. Classified electronics equipment. Palo Alto and Scotsdale, Ariz. Army Electronics Command, Fort Monmouth, N.J.

3—**Global Associates**, Oakland, Calif. $1,528-125 (contract modification). Logistics support of the Kwajalein Missile Range, Marshall Islands. Army Safeguard System Command, Huntsville, Ala. DA-HC60-70-C-0001.

—**AVCO Corp.**, Stratford, Conn. $6,695,000. Titanium rotor modification kits for T-53 turbine engines. Charleston, S.C. Army Aviation Systems Command, St. Louis, Mo. AF-41-608-69-A2421.

—The following contract modifications for M514A1E1 fuze units were awarded by Harry Diamond Laboratories, Washington, D.C.:

  Raytheon Co., Bristol, Tenn. $2,734,740. DA-AG39-70-C-0028.

  Fairchild Camera and Instrument Corp., Copiague, N.Y. $1,350,300. DA-AG39-70-C-0027.

4—**Lockheed Aircraft Corp.**, Sunnyvale, Calif. $4,000,000. Design, fabrication, field installation monitoring, check out and operation of the experimental system for the Diamond Sculls underground nuclear test at the Nevada test site. Sunnyvale and Seattle, Wash. Defense Atomic Support Agency, Washington, D.C. DS-SA01-70-C-0077.

—The following contracts were issued by the Army Ammunition Procurement and Supply Agency, Joliet, Ill.:

  Chamberlain Manufacturing Corp., Elmhurst, Ill. $9,716,200. Metal parts for 155mm high explosive projectiles, M107. Scranton, Pa. DA-AA09-70-C-0304.

  AVCO Economics Systems Corp., Washington, D.C. $2,629,423 (contract modification). Repairing and manufacturing ammunition components and ancillary equipment. Glasgow, Mont. DA-AA13-69-C-0064.

6—**Carter Construction Co., Inc.**, Benton, Ark. $1,184,000. Excavation of an auxiliary navigation channel along Sans Bois Creek, Haskell County, Okla., as part of the Robert S. Kerr Lock and Dam Project. Army Engineer District, Tulsa, Okla. DA-CW56-70-C-0081.

—**Raytheon Co.**, Lexington, Mass. $1,085,-522. Metal parts assembly for M905 tail bomb fuzes. Bristol, Tenn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0288.

—**Jahncke Service Corp.**, New Orleans, La. $1,194,100. Maintenance dredging of shoal material from the Mississippi River Gulf outlet channel as part of the Mississippi River Gulf Outlet Project. St. Bernard and Plaquemines parishes, La. Army Engineer District, New Orleans, La. DA-CW29-70-C-0158.

—**ITT Gilfillan**, Van Nuys, Calif. $4,600,-000. RATAC radar systems and ET/ST model radar systems, AN/TPS-58. Van

Nuys and Europe. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0176.

11—Action Manufacturing Co., Philadelphia, Pa. $1,056,515. Metal parts for M905 bomb tail fuzes. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0289.

12—Raytheon Co., Bedford, Mass. $9,950,000 (contract modification). Advanced development of the SAM-D missile system. Bedford, Orlando, Fla., White Sands Missile Range, N.M., and Wayland, Mass. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1995.

13—Chrysler Motor Corp., Warren, Mich. $1,953,912. Stake trucks. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3244.

16—Honeywell, Inc., North Hopkins, Minn. $1,449,092 (contract modification). Metal parts for point detonating fuzes, M551. New Brighton, Minn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0104.

—Revere Copper and Brass, Inc., Detroit, Mich. $1,021,510. 1,282,820 pounds of 220 alloy for bullet jackets. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0499.

—Juett Construction Co., Winchester, Ky. $2,077,745. Relocation of 7.8 miles of Highway 701, Rowan County, Ky., for the Cave Run Reservoir Project. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0072.

17—Communications and Systems, Inc., Falls Church, Va. $1,000,000 (contract modification). Classified research and development. Army Electronics Command, Fort Monmouth, N.J.

—Chamberlain Manufacturing Co., Waterloo, Iowa. $1,590,625. Metal parts for high explosive warheads for 2.75 inch rockets, M151. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0171.

—AVCO Corp., Stratford, Conn. $1,024,150. Contract kits for T-55 turbine engines for CH-47 helicopters. Army Aviation Systems Command, St. Louis, Mo. AF-41-608-69-A2421.

18—Duane Smelser Roofing Co., Warren, Mich. $1,311,900. Roof replacement on a master control room building modification, and repair of the cathodic protection system, Army Missile Plant, Sterling Heights, Mich. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0043.

—Marathon Battery Co., St. Paul, Minn. $1,520,000. High and low temperature protection testing and engineering samples. Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-1452.

—The following contracts for metal parts for 81mm mortar fuzes M524A6 were awarded by the Army Ammunition Procurement and Supply Agency, Joliet, Ill.:

KDI Precision Products, Cincinnati, Ohio. $2,922,651. DA-AA09-70-C-0324.

Lear Siegler, Inc., Anaheim, Calif. $2,742,000. DA-AA09-70-C-0325.

Penn Akron Corp., Long Island City, N.Y. $2,104,200. DA-AA09-70-C-0326.

I. D. Precision Component Corp., Jamaica, N.Y. $1,457,400. Gadsden, Ala., and Jamaica. DA-AA09-70-C-0327.

19—Xerox Corp., Pasadena, Calif. $2,199,000. and $2,458,000. Gated night sites for the TOW missile system. Pomona, Calif. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0347 and DA-AK02-70-C-0346.

20—Bell Helicopter Co., Fort Worth, Tex. $20,000,000 (Air Force funds). UH-1H utility helicopters. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0066.

—Institute for Defense Analysis, Arlington, Va. $1,634,125 (contract modification). Research for the Dir., Defense Research and Engineering and for the Advanced Research Projects Agency, Defense Supply Service, Washington, D.C. DA-HC15-67-C-0011.

23—Western Electric Co., New York, N.Y. $6,774,300 (contract modification). Components for the Safeguard Missile Site radar. Burlington, N.C. Army Safeguard [illegible] Ala. DA-

—Ingraham Industries, McGraw Edison Div., Bristol, Conn. $3,543,284. MTSQ fuzes, M564. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0217.

—International Telephone and Telegraph Corp., Nutley, N.J. $1,017,922 (contract modification). Engineering changes to AN/GRC-143 radio sets. Army Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0001.

24—Valley Construction Co., Columbus, Miss. $1,472,383. Construction of a two story underground Civil Defense Federal Regional Emergency Operating Center building, Thomasville, Ga. Army Engineer District, Savannah, Ga. DA-CA21-70-C-0036.

—University of Wisconsin, Madison, Wis. $1,280,000 (contract modification). Basic research on interdisciplinary research in the mathematical sciences. Army Research Office, Durham, N.C. DA-31-124-AROD-00462.

—Hamilton Watch Co., Lancaster, Pa. $3,365,752. MTSQ fuzes, M564. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0218.

—Bell Helicopter Co., Amarillo, Tex. $1,914,096. Repair of 48 UH-1 series crash-damaged helicopters. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-C-0056.

—Chrysler Corp., Centerline, Mich. $5,106,011 (contract modification). System engineering management for the M60A1E2 tank program. Army Weapons Command, Rock Island, Ill. DA-AF03-69-C-0087.

25—General Motors Corp., Detroit, Mich. $1,185,581. 8V71-T diesel engines for M109 and M578 combat vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3234.

—Magnavox Corp., Urbana, Ill. $2,742,061. Light weight airborne radio sets, AN/ARC-131. Procurement Div., Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0179.

—Bridgeport Brass Co., Bridgeport, Conn. $1,718,366. 2,888,010 pounds of cartridge case cups. Indianapolis, Ind. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0498.

26—Great Lakes Dredge and Dock Co., Cleveland, Ohio. $1,466,000. Spring maintenance dredging in the Cuyahoga and Old Rivers, Cleveland Harbor Project. Army Engineer District, Buffalo, N.Y. DA-CW49-70-C-0039.

—Brezina Construction Co., Inc., Rapid City, S.D. $2,333,901. Widening and rehabilitation of 2.6 miles of embankment to accommodate a four lane highway, 40 miles south of Minot, N.D. Army Engineer District, Omaha, Neb. DA-CW45-70-C-0068.

—National Presto Industries, Inc., Eau Claire, Wis. $10,212,212 (contract modification). Metal parts for 105mm high explosive projectiles, M1. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0028.

—General Motors Corp., Detroit, Mich. $3,096,518 (contract modification). 6V53 diesel engines for M113A1 combat vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-0112.

27—The Army Aviation Systems Command, St. Louis, Mo., issued the following contracts:

Chandler Evans, Inc., West Hartford, Conn. $1,136,520. Conversion of fuel controls for UH-1 helicopter engines. DA-AJ01-70-D-0088.

The Boeing Co., Philadelphia, Pa. $3,493,188. Modification kits, transmissions, servocylinders, shipping and storage containers and inspection kits for support of CH-47 helicopters. Morton, Pa. DA-AJ01-68-A-0006.

—Southwest Truck Body Co., Inc., St. Louis, Mo. $1,227,630. 6-ton, two wheel semi-trailer vans, M373A2. West Plains, Mo. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-03341.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Hercules, Inc., Wilmington, Del. $4,052,141 (contract modification). Operation of propellant production facilities, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-00037(A).

Uniroyal, Inc., New York, N.Y. $3,748,785 (contract modification). [illegible] of explosives, loading, [illegible] packing 105mm cartridges, [illegible] ation of the Army Ammuniti[illegible] Joliet, Ill. DA-11-173-AMC-000[illegible]

Olin Corp., Stamford, Conn. $[illegible] (contract modification). Oper[illegible] propellant production facilitie[illegible] Army Ammunition Plant, Bara[illegible] DA-AA09-69-C-0014.

Airport Machining Corp., Mar[illegible] $1,733,400. Metal parts for [illegible] rocket warheads, M151. [illegible] Tenn. DA-AA09-70-C-0170.

Eureka Williams Co., Blooming[illegible] $1,542,060. Metal parts for bo[illegible] M904E2. DA-AA09-70-C-0[illegible].

30—American Air Filter Co., Inc., [illegible] Mo. $2,442,980. 211 fire trucks [illegible] fighting equipment sets. Army [illegible] Equipment Command, St. Louis, [illegible] AK01-70-C-6299.

—Pettibone Corp., Rome, N.Y. $[illegible] 163 truck cranes of 10,000-pound [illegible] Army Mobility Equipment Comm[illegible] Louis, Mo. DA-AK01-70-C-6[illegible].

—Gulf and Western Industries, Inc., [illegible] sha, Wis. $5,567,400. 20mm [illegible] cases, M103. Frankford Arsenal, [illegible] phia, Pa. DA-AA25-70-C-0495.

—Martin-Zachry Constructors, [illegible] Hawaii. $1,256,778. Preparation [illegible] struction of a remote launch site [illegible] Illeginni Island, Kwajalein Atoll, [illegible] Islands. Army Engineer District, [illegible] Hawaii. DA-CA83-70-C-0014.

31—The Army Ammunition Procure[illegible] Supply Agency, Joliet, Ill., awa[illegible] following contracts:

Thiokol Chemical Corp., Bris[illegible] $8,404,782 (contract modificatio[illegible] ing, assembling and packing [illegible] and illuminating signals, [illegible] Army Ammunition Plant, Mars[illegible] DA-11-173-AMC-00200.

Mason and Hanger, Silas Ma[illegible] Inc., New York, N.Y. $3,[illegible] tract modification). Loading, [illegible] and packing bombs and proje[illegible] operation of the Cornhuskers A[illegible] munition Plant, Grand Island, [illegible] AA09-68-C-0383. $14,984,85[illegible] modification). Loading, assem[illegible] packing projectiles and [illegible] Army Ammunition Plant, [illegible] Iowa. DA-AA09-68-C-0408.

Olin Corp., Stamford, Conn. $[illegible] (contract modification). Prope[illegible] ammunition components, and [illegible] of the Army Ammunition Plant, [illegible] town, Ind. DA-AA09-69-C-0146.

Firestone Tire and Rubber Co., [illegible] Ohio. $2,208,506 (contract modi[illegible] Loading, assembling and packing [illegible] jectiles and components, and [illegible] of the Army Ammunition Plant, [illegible] na. DA-AA09-70-C-0002.

—Zurn Engineers, Upland, Calif. $[illegible] Construction of the water supply [illegible] for the Grand Forks, N.D., Safeg[illegible] Walsh, Pembina and Cavalier [illegible] N.D. Army Engineer District, [illegible] Nebr. DA-CA45-70-C-0067.

—Keane Construction Co., Inc., [illegible] N.J. $1,250,000. Officer's open [illegible] Guire AFB, N.J. Army Engineer [illegible] New York, N.Y. DA-CA51-70-C-[illegible]

—Olin Corp., Stamford, Conn. $[illegible] Loading, assembling and packing [illegible] cartridges, M56A3. LaPorte, Ind. [illegible] ford Arsenal, Philadelphia, Pa. [illegible] 70-C-0529.

—Copperweld Steel Co., Glassport, [illegible] 380,800. 1,080,000 squares (100 sq. [illegible] noncorrosive copper-coated steel [illegible] forcing fabric for river bank [illegible] work. Army Engineer District, [illegible] Tenn. DA-CW66-70-C-0091.

—Ben Construction Co., Pittsburgh, [illegible] 765,778. Widening, deepening, and [illegible] ening 2½ miles of Chartier's Cr[illegible] negie-Bridgeville section, Pittsbur[illegible] Engineer District, Pittsburgh, [illegible] CW59-70-C-0159.

—Guy H. James Construction Co., [illegible] City, Okla. $8,486,150. Work at [illegible] 'ville Reservoir, east fork of [illegible] Water River, Ind. Army Engine[illegible] trict, Louisville, Ky. DA-CW2[illegible]

—The Army Aviation Systems Comma[illegible] Louis, Mo. awarded the follow[illegible] tracts:

May

General Motors Corp., Indianapolis, Ind. $1,657,677. Product improvement program for the T-63 turbine engine. DA-AJ01-70-C-0528.
The Boeing Co., Philadelphia, Pa. $46,-287,544. CH-47 helicopters. Ridley Park, Pa. DA-AJ01-70-C-0505.
Bell Helicopter Co., Fort Worth, Tex. $7,364,644. UH-1N helicopters. Hurst, Tex. DA-AJ01-69-C-0085.

—Teledyne Industries, Muskegon, Mich. $4,-176,177. Model AVDS-1790-2A engine assemblies for M60 and M48 tanks. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3247.

—Morrison Knudson Co., Inc., Peter Kiewit Sons Co., Fishbach and Moore, and C.H. Leavell and Co., Boise, Idaho. $137,858,850. Safeguard defense system technical facilities (missile site radar and perimeter acquisition radar sites). Cavalier and Pembine Counties, N.D. Army Engineer Division, Huntsville, Ala. DA-CA87-70-C-0013.

—Aluminum Co. of America, Pittsburgh, Pa. $2,980,744. 104 bridge erection boats. New Kensington, Pa. Army Mobility Equipment Command, St. Louis, Mo., DA-AK01-70-C-6289.

DEPARTMENT OF THE NAVY

2—Collins Radio Co., Richardson, Tex. $1,-190,439. Spare parts to support master radio stations serving Coast Guard vessels. Naval Aviation Supply Office, Philadelphia, Pa. N00383-68-A-1300-0774.

—Quality Motels Construction Corp., and Quality Courts Motels, Inc., Silver Spring, Md. $2,098,600. Construction of temporary lodgings facility, Naval Complex, Norfolk, Va. Naval Facilities Engineering Command, Washington, D.C. N62470-70-C-0956.

3—Alaska-Puget-United Transportation Co., San Francisco, Calif. $18,120,000. Supply of defense and Federal Government sites in Alaska for a 5 year period, beginning May 1970. Military Sea Transportation Service, Brooklyn, N.Y.

4—Texas Instruments, Inc., Dallas, Tex. $1,-898,485. Design, develop and fabricate a fully integrated guidance control group for the Bulldog missile system, and provide related services for models. Naval Purchasing Office, Los Angeles, Calif. N00123-70-C-0671.

5—American Construction Co., Washington, D.C. $1,491,885. Construction of a hypervelocity wind tunnel building at the Naval Ordnance Laboratory, White Oak, Md. Naval Engineering Facilities Command, Washington, D.C. N62477-68-C-0086.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:
Raytheon Co., Lexington, Mass. $17,-990,400 (contract modification). Guidance and control groups for Sparrow missiles for the Navy and Air Force. Lowell and Bedford, Mass., Bristol, Tenn., and Oxnard, Calif. N00019-69-C-0368. $6,900,013. Guidance and control groups for Sidewinder IC missiles. Lowell, Mass. N00019-70-C-0299.
McDonnell Douglas Corp., Long Beach, Calif. $2,300,000 (contract modification). Increased long lead time funding to support FY 1970 procurement of TA-4J and A-4M aircraft. N00019-67-C-0170.
United Aircraft Corp., East Hartford, Conn. $4,160,760. Fabrication of YTF-30-P-412 engines and conversion of TF-30-P-12 engines to the YTF-30-P-412 version. N00019-69-C-0614.
Sanders Associates, Inc., Nashua, N.H. $4,034,616. AN/SSQ-53 sonobuoys. N00019-70-C-0432.

6—General Electric Co., Schenectady, N.Y. $10,000,000. Design and furnishing of nuclear propulsion components. Naval Ship Systems Command, Washington, D.C. N00024-67-C-5321.

9—Fairchild Camera and Instrument Corp., Copiague, N.Y. $2,142,000. Electric bomb fuzes. Atglen, Pa., and Copiague. Naval Air Systems Command, Washington, D.C. N00019-70-C-0441.

—Francisco Levy, Hijo, Inc., San Juan, P.R. $7,265,600. Construction of a hospital and corpsman barracks, Naval Station, Roosevelt Roads, P.R. Naval Facilities Engineering, Washington, D.C. N62475-70-C-0024.

—Singer-General Precision, Inc., Little Falls, N.J. $1,040,000. Spare parts for intertial measurement systems for A-7D and -7E aircraft. Naval Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3201-0265.

—Bendix Corp., North Hollywood, Calif. $1,-526,000. Production support and redesign of component parts for the Mk 46 torpedo control and guidance system. Naval Purchasing Office, Los Angeles, Calif. N00123-70-C-0763.

—The Naval Ship Systems Command, Washington, D.C., issued the following contracts for the design, construction and testing of a full scale mockup model of the amphibious assault landing craft (AALC):
Bell Aerospace Co., Buffalo, N.Y. $1,-950,000. Wheatfield, N.Y. N00024-70-C-0267.
Aerojet-General Corp., El Monte, Calif. $1,262,369. N00024-70-C-0268.

—The Naval Ordnance Systems Command, Washington, D.C., issued the following contracts:
Westinghouse Electric Corp., Baltimore, Md. $8,000,000. Long lead time material for Mk 48 Mod 0 torpedoes. Landsdowne, Md. N00017-70-C-1211.
Clevite Corp., Cleveland, Ohio. $17,071,-317. Fabricate and produce preproduction prototype Mk 48 Mod 1 torpedoes. N00017-69-C-1426.

10—General Dynamics Corp., Pomona, Calif. $4,704,690 (contract modification). Additional funds for the Standard ARM (AGM-78) missile program for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-69-C-0336.

11—Piedra Corp., Wichita Falls, Tex. $1,600,-899. Construction of family housing, Naval Air Station, Beeville, Tex. Naval Facilities Engineering Command, Washington, D.C. N62468-70-C-0008.

—Sperry Rand Corp., Syosset, N.Y. $1,346,-150. Poseidon navigation trainer conversion. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0061.

12—Sperry Rand Corp., Charlottesville, Va. $1,402,779. Radar sets, repair parts and engineering services. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1212.

13—The Naval Air Systems Command, Washington, D.C., issued the following contracts:
VAST, Inc., Waterford, Conn. $1,836,-455. Engineering testing, preproduction sample testing, and production lot sample testing for quality control of sonobuoys, bathythermograph transmitter sets and underwater sound signals. South Bristol, Maine, and St. Croix, V.I. N00019-70-C-0341.
Hughes Aircraft Co., Culver City, Calif. $6,450,000 (contract modification). Installment funding for the Phoenix missile program for FY 1970. N00019-67-C-0240.
Lockheed Aircraft Corp., Burbank, Calif. $5,599,213 (contract modification). Increase long lead time funding for FY 1970 P-3C aircraft. N00019-69-C-0237.

16—Honeywell, Inc., St. Petersburg, Fla. $4,-343,244. Poseidon inertial guidance components. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0064.

17—General Dynamics Corp., Pomona, Calif. $3,505,000 (contract modification). Long lead time items for Standard ARM missiles. Naval Ordnance Systems Command, Washington, D.C. N00017-67-C-2107.

19—General Electric Co., Pittsfield, Mass. $7,-787,472. Guidance system assemblies for Poseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0121.

—United Aircraft Corp., East Hartford, Conn. $1,144,608. Spare parts for YTF-30-P-412 engines for the F-14A. Naval Aviation Supply Office, Philadelphia, Pa. N000383-0-69000A-AH100.

—Data Products Corp., Woodland Hills, Calif. $1,476,483. High speed data line printers. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1203.

23—Hughes Aircraft Co., Culver City, Calif. $7,835,947. Flight test program for the AIM-54A Phoenix missile. Naval Air Systems Command, Washington, D.C. N00019-70-C-0346.

—Western Electric Co., New York, N.Y. $5,114,422. Cable-laying equipment. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3529.

—General Dynamics Corp., Pomona, Calif. $4,375,300. Engineering services to investigate missile performance during fleet firing support of the Terrier, Tartar and Standard missile systems integrated logistics support program. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2207.

—Bell Helicopter Co., Hurst, Tex. $1,843,-976. Rotor blades, drive mechanisms and components for UH-1N helicopters. Naval Aviation Supply Office, Philadelphia, Pa. DA-AJ01-69-A-0314GBCG.

—Oshkosh Motor Truck Inc., Oshkosh, Wis. $1,543,455. 27 aircraft crash fire fighting and rescue trucks. Naval Facilities Engineering Command, Washington, D.C. N62465-70-C-0324.

—Sperry Rand Corp., St. Paul, Minn. $1,-098,420. Computer components and associated spare parts. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1221.

24—Honeywell, Inc., Minneapolis, Minn. $12,-055,477 (contract modification). Second half FY 1970 procurement of Rockeye II weapons system components. Naval Air Systems Command, Washington, D.C. N00019-70-C-0140.

—Texas Instruments, Inc., Dallas, Tex. $3,000,000. Design, development and fabrication of AN/APS-116 radar sets for S-3A aircraft. Naval Air Systems Command, Washington, D.C. N00019-70-C-0398.

25—The Naval Ship Systems Command, Washington, D.C., issued the following contracts:
General Electric Co., Schenectady, N.Y. $6,834,000. Designing and furnishing nuclear propulsion components. N00024-70-C-5388. $2,000,000 (contract modification). Nuclear propulsion research and development. N00024-70-C-5027.
North American Rockwell Corp., Anaheim, Calif. $1,300,000. Refurbishment and modification of Ships Inertial Navigation Systems (SINS). N00024-70-C-5419.

—Construcciones Werl, Inc., Bayamon, P.R. $1,323,338. Sewage treatment plants, Naval Station, Roosevelt Roads, P.R. Naval Facilities Engineering Command, Washington, D.C. N62475-70-C-0006.

—Fuller-American, San Diego, Calif. $2,-354,400. Construction of a base brig, Chappo Area, Camp Pendleton Marine Base, Calif. Naval Facilities Engineering Command, Washington, D.C. N62473-70-C-0030.

26—FMC Corp., Minneapolis, Minn. $8,900,-000. Design, development and prototype production of the Mk 26, Mods 0, 1 and 2, missile launching system. Naval Ordnance Systems Command, Washington, D.C. N00017-68-C-2100.

—General Electric Co., Pittsfield, Mass. $14,-568,890. Fire control and guidance support equipment (phase IIIB) for Poseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030-69-C-0125.

—Honeywell, Inc., Hopkins, Minn. $2,368,-280. Mk 46 Mod 1 torpedoes and ancillary parts. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-1307.

—Aerojet-General Corp., Sacramento, Calif. $2,632,796. Sparrow missile rocket motors

for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-1229.

—**Philco-Ford Corp.**, Philadelphia, Pa. $2,-433,684. 12 shipboard computer displays. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1229.

—**Kollsman Instrument Corp.**, Elmhurst, N.Y. $1,148,936. Mk 90 Mod 1 and Mk 91 Mod 0 proximity fuzes. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A083.

27—**ITT Gilfillan Corp.** Van Nuys, Calif. $17,-592,000. AN/SPS-48(V) radar sets. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1200.

—**The Boeing Co.**, Seattle, Wash. $1,351,817. Special research and development trials of two hydrofoil vessels, PCH-1 and AGEH-1. Naval Purchasing Office, Washington, D.C. N00600-69-C-0618.

30—**Hughes Aircraft Co.**, Culver City, Calif. $13,075,092. Electronic assemblies for the Poseidon guidance system. El Segundo, Calif. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0056.

31—**North American Rockwell Corp.**, Columbus, Ohio. $5,603,600. OV-10B aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0696.

—**Singer-General Precision**, Binghampton, N.Y. $4,515,500. F-4E weapon system training sets (A/F 37U-T9), and installation at field sites. Binghampton and Sunnyvale, Calif. Naval Training Device Center, Orlando, Fla. N61339-70-C-0126.

—**Bell Helicopter Co.**, Hurst, Tex. $1,189,-977. AH-1J helicopter rotor blades, drive mechanisms and components. Naval Aviation Supply Office, Philadelphia, Pa. DA-AJ01-69-A-0314-GBCZ.

—**RF Communications, Inc.**, Rochester, N.Y. $1,827,017. AN/URC-58(V) transceivers. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-0534.

DEPARTMENT OF THE AIR FORCE

2—**Thiokol Chemical Corp.**, Brigham City, Utah. $1,379,078. Basic rocket motors and related data for the Genie rocket. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-0026.

3—**Davies Supply and Manufacturing Co.**, St. Louis, Mo. $3,067,575. Furnishing and installing equipment for an electroplating process facility, Oklahoma City, Okla. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-2479.

—**North American Rockwell Corp.**, Anaheim, Calif. $1,575,000. Spare parts in support of the Minuteman III weapon system. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F04701-68-C-0280.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Electric Co., West Lynn, Mass. $1,379,646. Production of J-85 turbojet engines. F33657-69-C-0008. $1,119,-648. Production of J-85 turbojets and related spare parts. F33657-70-C-0220.

General Motors Corp., Indianapolis, Ind. $10,591,190. Production of T-41-A-1 and A-2 turbofan engines. F33657-67-C-0163.

Philco-Ford Corp., Newport Beach, Calif. $1,313,942. Aerospace ground equipment for airborne radar equipment. F33657-70-C-0345.

4—**United Aircraft Corp.**, Stratford, Conn. $4,737,632. Components parts for helicopters. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-2087.

9—**Lockheed Aircraft Corp.**, Marietta, Ga. $3,325,888. Spare parts for C-5A aircraft. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. AF33(657)15053. $35,-756,000. C-130E aircraft, spare parts and aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0481.

10—**Lear Siegler, Inc.**, Grand Rapids, Mich. $4,300,000. Modification of the navigation system of F-4D aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0877.

11—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Electric Co., West Lynn, Mass. $2,780,356. Production of T-64-GE-413 turboshaft engines. F33657-69-C-1214.

General Electric Co., Cincinnati, Ohio. $3,000,000. Development of an advanced turbine engine gas generator. Evendale, Ohio. F33657-70-C-0340. $5,000,000. Engineering effort and services applicable to the TF-39 engine. Evendale, Ohio. F33657-70-C-0531.

—The Electronic Systems Division, AFSC, L.G. Hanscom Field, Mass., issued the following contracts:

Westinghouse Electric Corp., Baltimore Md. $5,950,000. Design, manufacture, test and delivery of tactical air defense system with spares and support equipment. F19628-70-C-0119.

Raytheon Co., Burlington, Mass. $3,900,-000. Operation and maintenance of communication sites. F19628-70-C-0021.

—The following contracts were awarded by the Ogden Air Materiel Area, AFLC, Hill AFB, Utah:

Superior Steel Ball Co., New Britain, Conn. $1,533,000. Component parts for anti-personnel bombs. Washington, Ind. F42600-70-C-0655.

AiResearch Manufacturing Co., Los Angeles, Calif. $1,738,428. Modification and repair of central air data computer components applicable to the RF-4 series aircraft. Torrance, Calif. F04606-69-A-0207.

12—**M-B Associates**, San Ramon, Calif. $1,-024,000. Auxiliary penetration aid. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04606-69-A-0239.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

LTV Electrosystems, Inc., Dallas, Tex. $1,533,885. Communications equipment. F33657-70-C-0325.

Lockheed Aircraft Corp., Marietta, Ga. $50,000,000. C-5A aircraft. AF33(658)-15053.

13—**Hayes International Corp.**, Birmingham, Ala. $2,251,283. Inspection and repair, as necessary, maintenance and modification of C-130 aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-0793.

—**General Dynamics Corp.**, Fort Worth, Tex. $6,746,705. Spare parts for F-111 aircraft. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. AF33(657)13403.

—**Singer-General Precision, Inc.**, Binghamton, N.Y. $2,379,397 (contract modification). F-111 mission simulators. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33657-15427.

—The San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex., issued the following contracts:

Kollsman Instrument Corp., Elmhurst, N.Y. $1,140,481. Pressure temperature test sets. F41608-69-D-0020.

AiResearch Manufacturing Co., Phoenix, Ariz. $4,525,562. Gas turbine engines. F41608-70-D-1401.

16—**United States Underseas Cable Corp.**, Washington, D.C. $5,296,861. Engineering, furnishing and installing a submarine cable system in the Pacific. Simplex Wire and Cable Co., Newington, N.H. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla.

17—**North American Rockwell Corp.**, Canoga Park, Calif. $2,708,416. Thor missile propulsion systems. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0333.

19—**General Electric Co.**, West Lynn, Mass. $2,800,000. T-64 aircraft engine components. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0545.

23—The Boeing Co., Seattle, Wash. $2,009,837. Design, development, study and test programs for Minuteman missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0153.

24—**General Dynamics Corp.**, Fort Worth, Tex. $11,730,000. F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)13403.

25—The Space and Missile Systems **Organization**, AFSC, Los Angeles, Calif., awarded the following contracts:

McDonnell Douglas Corp., Huntington Beach, Calif. $1,695,000. Launch support services and related tasks supporting Thor booster space programs. **Huntington Beach and Vandenburg AFB, Calif.** F04701-70-C-0037.

General Motors Corp., Goleta, Calif. $1,-799,697. Hypervelocity Range Research Program. F04701-70-C-0118.

AVCO Corp., Greenwich, Conn. $9,225,-627. Ballistic missile penetration aids. F04701-68-C-0039.

—**Doehler-Jarvis Div., National Lead Co.**, Toledo, Ohio. $1,151,967. Component parts for munitions. Batavia, N.Y., and Toledo. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-0661-P003.

—**General Electric Co.**, West Lynn, Mass. $1,000,000. Component improvement program for T-58 and J-85 series aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0545-P002.

26—**General Electric Co.**, Cincinnati, Ohio. $13,-100,000. TF-39 turbofan aircraft engines. Evandale, Ohio. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)15003.

27—**Lockheed-Georgia Co.**, Marietta, Ga. $3,-974,074. C-5A spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF 33(657)15053.

—**United Aircraft Corp.**, East Hartford, Conn. $2,007,200. Repair kits for TF-30 series aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. N383-69000A-SC45.

30—**Hayes International Corp.**, Birmingham, Ala. $1,361,394. Management and operation of the Air Force Publications Distribution Center, Baltimore, Md. Procurement Div., 2750th Air Base Wing, Wright-Patterson AFB, Ohio. F33600-70-C-0242.

—**The Boeing Co.**, Wichita, Kan. $1,162,290. Modification kits for C-135 and KC-135 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-A-0419.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, awarded the following contracts:

General Dynamics Corp., Fort Worth, Tex. $51,081,576. F-111 aircraft. AF33(657)-13403.

Bendix Corp., Teterboro, N.J. $2,880,000. Computers for F-105 and F-106 aircraft. F33657-70-C-0880.

31—Lear Siegler, Inc., Grand Rapids, Mich. $1,541,556. AN/AJB-7 computer components applicable to aircraft bombing systems. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0192.

—International Telephone and Telegraph Corp., Nutley, N.J. $1,905,000. QRC-510 electronic countermeasure equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0816.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., awarded the following contracts:

The Boeing Co., Seattle, Wash. $1,276,-600. Installation and test support for the hard rock silo development program. F04701-69-C-0186.

Philco-Ford Corp., Palo Alto, Calif. $4,-500,000. Operation and maintenance of Air Force Satellite Control Facility tracking stations, New Boston, N.H. F04701-70-C-0114.

Lockheed Aircraft Corp., Sunnyvale, Calif. $4,300,000. Operation of AF Satellite Control Facility tracking stations. F04701-70-C-0013. $3,078,000. Operation and maintenance of AF Satellite Control Facility tracking stations, Alaska and Hawaii. F04701-70-C-0012.

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Air Force Gets New Centrifuge

A multi-stress device, called a dynamic environment simulator (DES), has been placed into operation by the Air Force at the Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio. It was designed for the laboratory by The Franklin Institute Research Laboratories, Philadelphia, Pa.

The large, sophisticated centrifuge has a rotating mass of 180 tons and was designed to determine tolerance limits of the human body to a variety of environmental conditions that exist in high speed aircraft and in space flight.

Among the flight effects which the DES duplicates are acceleration and deceleration of different intensities, with onset over varying periods, in any direction through the body, tossing, tumbling, buffeting, and other random motions; and vibrations of the type produced by various rocket launching systems. These motions may be coupled with diverse degrees of atmospheric pressure, temperature, and humidity inside the cabin, to measure the total amount of stress induced by the flight environment.

The DES consists of three basic rotating parts: the arm which can reach 56 revolutions per minute and 20 gs; the fork gondola which reaches 30 rpm; and the cab which reaches 160 rpm.

Military Construction Request for FY 1971 Totals $2.069 Billion

The Defense Department has submitted to Congress a Military Construction Authorization Bill for FY 1971 totaling $2,069,094,000. The bill includes authorizations in support of the military services, the defense agencies and the reserve components.

Projects included in the authorization request are located at 260 named military installations in the United States, the Caribbean, Europe, Pacific Islands, Japan and Korea.

Also included in the total request is $809,038,000 for military family housing. New construction of family housing units accounts for $196,507,000 of this total, for 8,000 units in the United States and overseas. The balance represents maintenance and operation, improvements to existing quarters, leasing costs, and payments of principal and interest on mortgage obligations.

Major elements of the authorization request are contained in table below.

Proposed Military Construction Authorization for FY 1971

	U.S. Locations	Overseas Locations	Not Specified	Total
Army	$ 514,877,000	$112,578,000	$ —	$ 627,455,000
Navy	258,469,000	25,752,000	—	284,221,000
Air Force	223,422,000	43,858,000	—	267,280,000
Reserve Components	37,500,000	—	—	37,500,000
Defense Agencies	8,600,000	—	35,000,000	43,600,000
Subtotal	$1,042,868,000	$182,188,000	$35,000,000	$1,260,056,000
Military Family Housing	—	—	—	809,038,000
Total	$1,042,868,000	$182,188,000	$35,000,000	$2,069,094,000

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AFCS and GEEIA Join, Move to New Headquarters

The Air Force has announced the restructuring and relocation of the Air Force Communications Service (AFSC), Scott AFB, Ill., and its consolidation with the Ground Electronics Engineering Installation Agency (GEEIA), Griffis AFB, Rome, N.Y. The command will retain the AFCS designation and will be headquartered at Richards-Gebaur AFB, Mo.

The merger will give the Air Force a single manager concept for communications-electronics, capable of performing engineering, installation, operation and maintenance. Consolidation is expected to produce a savings of $14 million annually, with manpower reductions of 2,100 persons.

The action includes reorganization of intermediate headquarters, and collocation and union of AFCS and GEEIA units throughout the world.

Eliminated in the consolidation are the six geographical divisions of the continental United States by AFCS and GEEIA. In their place are two new regions: the Northern Area, with headquarters at Griffis AFB, N.Y.; and the Southern Area, with headquarters at Oklahoma AFS, near Tinker AFB, Okla.

GEEIA's Pacific Region will be consolidated with AFCS's Pacific Communications Area, with headquarters at Wheeler AFB, Hawaii.

Activation of a special headquarters detachment at Richards-Gebaur AFB on March 15 marked the beginning of the relocation-consolidation process, which is expected to be completed by September 30. AFCS will assume command of the base on July 1.

Fireproof Flight Suits Tested

Air Force pilots may have a fireproof replacement for cotton flight suits in the near future, because of a fiber called polybenzimidazole (PBI).

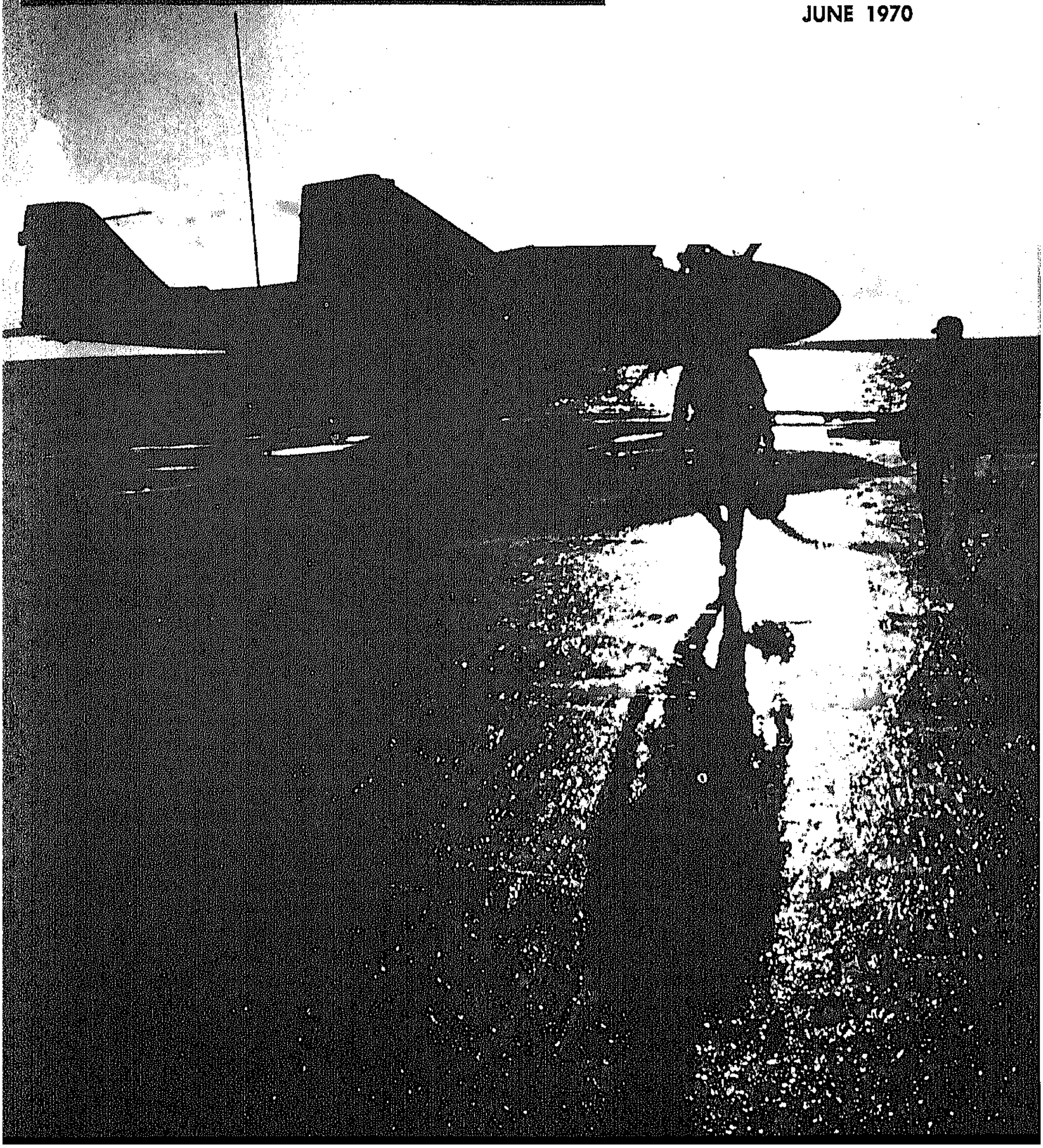
In comparison tests under conditions of jet fuel fires, with temperatures from 1,800 to 2,200 degrees F., PBI showed less than 10-percent body area burned, with only slight charring and no ignition. Cotton suits showed greater than 60 percent body area burned and non-melting nylon greater than 35 percent.

Of the three materials, only PBI provided protection against blistering for more than three seconds.

Wear tests of PBI cloth will be conducted this summer with the procurement of suits by the Life Support System Program Office, Aeronautical System Division, AFSC, Wright-Patterson AFB, Ohio.

DEFENSE INDUSTRY BULLETIN

JUNE 1970



DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 6 June 1970

Published for Department of Defense by Defense Supply Agency

The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

IN THIS ISSUE

FEATURES

DEPARTMENTS

A pilot and bombardier-navigator walk to the A–6A Intruder attack aircraft for an early morning launch. Naval Air Systems Command (NAVAIR) has the responsibility for development and procurement of Naval aircraft. An article on NAVAIR's program management begins on page 26.

How Do You Stack Up With Equal Employment Opportunity?

M. Robert Shafer

Achieving equality of opportunity for all citizens of our nation is one of our most serious and challenging national problems. The equality demanded must recognize the full dignity of the individual to seek and achieve his highest potential in productive employment, without regard to race, creed, color, religion, sex, or national origin. Circumvention of this right on any basis, not directly related to job performance, cannot be tolerated if we are to survive and prosper as a nation founded on the concepts of freedom and equality.

The goal of "equal employment opportunity" is a matter of national policy. In furtherance of this policy, we are committed to the concept of limiting the award of government contracts to firms which comply not only with the letter, but with the spirit of this national policy in their personnel practices.

On June 25, 1941, President Roosevelt issued an executive order forbidding employment discrimination in Government and in defense industries. A program landmark was formal implementation on March 6, 1961, with the President signing Executive Order 10925.

With the signing of this order, all government contracting agencies were required to include, in all future contracts, a provision binding government contractors to non-discriminatory personnel practices, except in specifically exempted contracts. The order was implemented by the President's Committee on Equal Employment Opportunity with compliance enforcement responsibility residing in each contracting agency. Agency jurisdiction over any specific contractor was based on dollar volume in contracts.

Executive Order 10925 was superseded on Sept. 24, 1965, by Executive Order 11246. These orders were essentially parallel except for the substitution of the Secretary of Labor for the President's Committee on Equal Employment Opportunity. As an interim measure, the Secretary of Labor announced retention of the rules and regulations of the defunct President's committee, until his newly created Office of Federal Contract Compliance was in a position to issue its own guidance.

Two months after the new executive order was signed, on Nov. 22, 1965, then Deputy Secretary of Defense Cyrus Vance announced the consolidation of compliance programs within the military departments and the defense supply agency under the Assistant Secretary of Defense for Manpower. The actual consolidation took place on July 30, 1966, and continued until July 1, 1967.

The organizational evolution, to this point, had done little to refine the compliance ground rules. It did, however, bring the program into perspective and surface the myriad problems involved in its administration. During the year of operation under the immediate direction of the Assistant Secretary of Defense for Manpower, it became increasingly apparent that a policy-making body had neither the capability nor the conceptual organization to intimately support the "grass root" problems of a nationwide compliance effort. A detailed management survey confirmed the need for organizational realignment to effectively enforce the provisions of the Equal Employment Opportunity Program. The recommendations of the survey led to the functional transfer, on July 1, 1967, of the DOD Compliance Program to the Defense Contract Administration Services (DCAS) of the Defense Supply Agency.

Thus, the present-day organization evolved for carrying out the DOD contract compliance responsibilities. Fundamental regulatory guidance flows from the Office of Federal Contract Compliance of the Department of Labor. It is translated into operational procedures by the Contract Compliance Office in DCAS. These are executed in subordinate elements within

the 11 DCAS regions covering the 50 states.

True Problems Emerge

The stage was set; the actors were in place. But it soon became apparent that the script was unclear. There were many unresolved questions.

What constitutes compliance?

The problem did not lie with contractors who were actively and openly equal opportunity employers. Nor was it difficult to isolate those who carried discrimination to the point of segregated work areas, restaurants, wash rooms, drinking fountains, parking lots, transportation and housing facilities. The crux of the problem—the real no-man's land—was in the subtle shadings, the inadvertent and often unintentional practices that are discriminatory in effect—practices that have survived through custom.

The questions to be answered were complex.

Just what does equal employment opportunity mean when superimposed on an existing industrial organization replete with intricate and far-reaching policies, practices, customs and mores that make up the corporate personality?

Where does a contractor start, and how does he achieve a posture of compliance? Once achieved, how is it maintained?

Can a contractor overcome present effect of past practices without discrimination in reverse?

By August 1968 we had refined a list of factors covering areas such as recruiting practices designed to attract minority groups, interviewing techniques which avoid bias, non-discriminatory test criteria and training programs, equality in facilities, and fair appraisal procedures. The list of factors, though circulated widely in the industrial community, was designed to assist the government compliance reviewer. Though still falling short of our goal, these factors did provide basic tools for objective evaluation.

Who Must Comply?

So far we have traced the government and DOD organization for contract compliance from the embryo state to its present design. We have considered a few of the major problems involved in assuring compliance. We have taken a brief look at our efforts to overcome these problems.

Let us now consider for a moment who must comply if they wish to deal with the Government. It may generally be said that all contractors holding government contracts in excess of $10,000 are contractually bound to effectively provide equal opportunity to all employees and potential employees. There are a few exceptions spelled out in the Armed Services Procurement Regulation.

For our purposes, a contractor is considered a government contractor whether under direct contract with the Government, or as a subcontractor at any tier. This requirement applies to all segments of the contractor's organization whether it be a single or multifacility organization, even though the contract is to be performed by a single isolated segment. This all encompassing requirement is the key—it is designed to force compliance. When the corporate entity accepts a contract, it commits the entire organization as an equal opportunity employer.

Order Number 4

Before we take a look at the implications of Order Number 4, let's see if we can't put the true meaning of equal employment opportunity in a reference context.

Equal opportunity can best be described as total consistence in all policies, procedures and actions dealing with the workforce in all job classifications throughout all levels of the corporate hierarchy. There must be no discrimination, either active or passive, with regard to race, creed, color, religion, sex, or national origin. The only exception is where an employee of a particular sex can be justified on the basis of specific job requirements.

A contractor with 50 or more employees and a contract of $50,000 or more must, in addition to compliance, develop and maintain a written affirmative action compliance program for each facility of his organization. This requirement for government contractors, outside the construction industry, was spelled out by the Department of Labor in its Order Number 4, which became effective on Jan. 30, 1970.

Order Number 4 provides clearcut and positive guidance, and even some suggested methods, for establishing an affirmative action program. These implementing guidelines are essentially patterned after those prepared in 1968 by Plans for Progress, the voluntary equal employment opportunity activity, which last year merged with the National Alliance of Businessmen. The rules of Order Number 4 are designed to carry out a July 1968 Labor Department directive requiring government contractors and subcontractors to develop written affirmative action compliance programs for each of their establishments. There remains little doubt concerning the mechanics and corporate attitude essential to effective compliance with the President's Equal Employment Opportunity Program. By virtue of its comprehensive coverage, contractors will find the going easier in implementing their own programs. Now various federal agencies, with contract compliance responsibility, have a handbook of common compliance measuring criteria.

Meaningful Application

The contractor's program must be detailed in a set of result-oriented procedures. He must then commit himself, in good faith, to exert the necessary effort to make the program successful. This combination—effort applied to meaningful procedures—is equal employment opportunity.

A prime requisite to the application of good faith effort is to determine present compliance status, and identify and correct deficiencies. There are many peripheral areas of compliance, such as poster display, the "equal opportunity employer" phrase in recruitment advertising, etc. These, while important, are only incidental to the central core of the problem—the underutilization of minorities.

The first step in a get-well program is diagnostic—a detailed analysis of the workforce composition in all major job categories. The analysis must avoid the superficial and get right down to the basic corporate structure. As an example, if the supervisory force is made up of categories such as general foreman, foreman, and assistant foreman, the analysis must treat each as a separate entity. This same approach applies to

all workforce job categories at all levels.

Order Number 4 tells us that the category-by-category analysis must, as a minimum, consider nine well defined factors which must be viewed in their broadest sense:

- Minority population of the labor area surrounding the facility.
- Degree of minority unemployment in the labor area surrounding the facility.
- Proportion of minority group members in the total work force in the immediate area.
- General availability of minorities having requisite skills in the immediate labor area.
- Availability of minorities having requisite skills in an area in which the contractor can reasonably recruit.
- Availability of minority employees who could be promoted within the contractor's organization.
- Anticipated expansion, contraction, and turnover of the workforce.
- Existence of training institutions capable of training minorities in the requisite skills.
- Degree of training which the contractor is reasonably able to undertake for making all job classes available to minorities.

Several of the factors mention "labor area surrounding the facility" or "immediate labor area." The parameters of a labor area will vary from facility to facility, and can be given dimension only when related to a particular case. Any useful generalization that can be made must be related to present workforce. If some of the regularly employed workers live a distance of 50 miles, then the parameters in both instances would be a 50-mile radius.

The seventh factor deals with workforce variations resulting from expansion, retrenchment, and turnover. Expansion and turnover provide obviously excellent vehicles for curing a problem of underutilization. The recent environment of retrenchment has been used by a few as an excuse for failure to aggressively pursue a course of affirmative action. This rationale is, at best, tenuous, unless the retrenchment is started from a point of full minority utilization at all levels of the organization. Regardless of the prevailing economic climate, a positive approach will achieve results.

The eighth and ninth factors address the availability of training in the requisite skills, and the degree to which a contractor is able to take advantage of training. Training in this context is given broad meaning, and reaches beyond the formal assemblage. Careful consideration must be given to the subtle, usually informal, quasi training programs, leading to progression through various levels of the organization. A prime example is the temporary and intermittent upgrading of an employee to a higher position as a vacancy-filling expediency. This action represents a form of training which often leads to a permanent promotion.

Certainly these nine factors are critical to the diagnosis, but cannot be considered all inclusive unless they, in fact, provide the basis for an effective program. The result of the analysis phase must be a comprehensive portrayal of minority employee utilization by job category, as well as the relationship to acceptable and reasonably available workforce resources. Any job category having fewer minority employees than would be reasonably expected by availability must be justified in detail, or translated into a goal.

Correction of Deficiencies

Goals and achievement timetables that form the basis of an affirmative action program flow from analysis. These goals should be significant, measurable, attainable, and provide comprehensive coverage in all job categories where minority groups are found to be underutilized.

The goals, timetables and affirmative action commitments must be designed to correct any identifiable deficiencies. This, with its attendant supporting data and analysis, is a mandatory part of a contractor's affirmative action program, and must be maintained at each of the contractor's facilities.

In carrying out a program, analysis and goal setting must receive special emphasis in those six areas found through experience to be weakest in minority utilization—officials and managers, professionals, technicians, sales workers, office and clerical, and skilled craftsmen.

The guidelines are clear, and enforcement provisions are available for dealing with contractors who fail to comply. These provisions are designed to provide the time necessary for a contractor to correct his deficiencies.

When a contractor is found lacking in his affirmative action program, the contract compliance agency puts the contractor on 30-day notice. During this period, he must either comply or show cause why enforcement proceedings should not be initiated.

If compliance is not achieved, or a good and sufficient cause for non-compliance is not presented within the 30 days, the compliance agency, with approval by the Office of Federal Contract Compliance, may issue a notice of proposed cancellation of existing contracts or subcontracts, coupled with debarment from future government business.

Following this notice, the contractor will be given a 10-day period in which to request a hearing. If no request is forthcoming, the contractor will be declared ineligible for future contracts. Existing contracts will be terminated for default.

During the "show cause" period, the compliance agency will make

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every effort to resolve the non-compliance deficiencies through conciliation, mediation and persuasion.

Equal employment opportunity initiative and accountability rest with the contractor to the same extent it does for compliance with any other terms and conditions of his contract. Industry management has a legal and moral obligation to set challenging and achievable goals leading to equal employment opportunity in its truest form.

Top management's influence is far more potent in its example than in its directive. In addition to verbal recognition, management must provide evidence through its demand for action —not merely understanding. Those involved in policy implementation, at all levels, must be made to understand that their future is directly related to their support. They must be tough minded—it concerns a tough problem calling for straight talk.

Companies may have a policy of nondiscrimination, but individuals, and groups of individuals, in an organizational structure practice discrimination. By its very nature, an act of discrimination typically emanates from the decision of one person, or a relatively small group of people. From this it follows that an effective program requires individual conversion, and solutions cannot be founded on organizational directive alone.

The policy of achieving a climate of equal employment opportunity must be supported with as much vigor as those directed at effective and profitable competition in the market place.

If It Is To Be, It Is Up To Me!

Excerpts from speech by Rear Admiral Joseph L. Howard, USN, Dep. Dir. for Contract Administration Services, Defense Supply Agency, to Contracts Compliance Office personnel attending a conference at Cameron Station, Va., Feb. 25, 1970.

* * * * *

It took courageous men, 200 years ago, to stand and fight for the freedom, the equality, and the individual self-respect we won in the American Revolution.

. . . it takes equal courage, and perhaps more, to fight today for the freedom, equality, and self-respect of *all* our people—all American citizens —in the well established society in which we live today.

You are among those courageous people. And those who have fought for the same ideals that you stand for can be found throughout the history of our nation.

* * * * *

. . . the United States faces a real crisis in the coming decade. The outcome, believe it or not, depends in great measure upon what you people here today do in the months immediately ahead not only by yourselves, but through the leadership you exercise, through the guidance you give your helpers, through the standards you insist upon in approving equal opportunity plans presented by our contractors.

* * * * *

Gentlemen, we must recognize that equal employment opportunity in our country *is not yet a fact.*

Certain groups of people have simply been cut out of the mainstream of our economy. We have identified these groups. We have analyzed them, discussed their condition, explained their plight, debated their values, and rationalized their failures. But we have not yet insured their equality.

It is becoming less and less important *why*
the black man
and the Indian
and the Oriental
and the Spanish-American
so often living in ghettos, receive inferior education, work only at the lowest paying jobs. The important thing now is that these are the facts, and we must correct these inequities.

* * * * *

We are the ones who have the responsibility.

We are the ones who face the challenge of peaceful, constructive, progressive changes—now and in the months immediately ahead—that can provide the equality for all our people that is so sorely lacking now.

Individually, we may think our part is quite small. But collectively, we are perhaps as important an operation as exists anywhere in the country today in the drive for equal job opportunity.

The civil rights problem is an issue of the first magnitude in our country. Contract compliance and equal employment opportunity are only a part of the total problem. But we must view the Contract Compliance Program within the context of the total problem.

We must recognize that we face the brutal possibility that our nation may be drifting toward two societies—one

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black, one white—separate, but unequal.

We must recognize that part of the strength of our nation has long been the heterogeneity of our citizenry. We have not been divided along lines of race, creed, nationality, or color where it comes to love of our country, loyalty to our flag, or willingness to fight and die for the American ideal.

We are part of a complex economic system in which we depend on the specialized abilities, skills, products, and services of each other.

The best interests of our country will be served only if we insure that *all* our people—black, white, red, yellow, brown—are given full opportunity to realize their fullest potentialities, their innermost hopes, dreams, and aspirations within the framework of individual responsibility and mutual respect among all people.

* * * * *

With a decent job, one that challenges his abilities, one that offers him the chance for advancement for betterment of his lot in life, one that permits him to plan happily for his children's own future, these problems ultimately come down to solutions which individual men can and will, if given a chance, work out by themselves.

I refer now to the joint responsibility of the Government and the business community.

I believe that the solution to the problems of our country lies within our grasp, but only if the Government and the business community are willing to make a full commitment to working out the solution.

* * * * *

We must get at the *subtle* areas of discrimination. In our reviews of company personnel practices, we must ferret out those areas that are buried deeply in the personnel files, the files that show where a white girl with a high school education and no working experience was hired into the accounting department in preference to a black girl with a college degree who applied at the same time for the same job.

We have to dig out those cases where a white man in the machine shop with 10 years experience was made foreman over the head of a black man with 15 years of identical experience and who displayed the same ambitions, leadership qualities, and supervisory potential.

We aren't going to make much of a dent in the problem by perfunctory reviews of personnel practices in the companies we do business with. We've got to dig deeply, and look at individual hiring cases, individual promotion cases, individual transfer cases, individual training opportunity cases.

We have got to inquire into specifics and see who the companies hired, and why, who they promoted, and why, who they gave training courses to, and why.

In other words, we must not be content merely with initial hiring practices. We must work closely with industry to rectify past wrongs. We must now vigorously embark on a program of upgrading the basic skills, the state of training, and the educational levels of those who do not now qualify, simply because they have never before been given a chance to qualify, or an opportunity to show what they can do.

The name of the game, gentlemen, is *affirmative action.* This means action all the way up and down the line, in all aspects of personnel administration, not just hiring, but also promotions, training, transfers, career incentives, and opportunities for company-sponsored graduate education.

I can assure you directly, here and now, that I personally, without reservation, am committed to this effort. You have my complete support, and I will repeat this to your regional commanders during our next commanders' conference.

You and your people must make this program part of your own conviction, your own belief, your own code of ethics—in this, we will have but a good start.

We must then be articulate, vigorous, and convincing in showing company officials that a fully integrated workforce, and a completely fair and equal personnel program, will mean progress, profits, and prosperity for their companies.

It comes down to your own individual conviction, and the sincerity of your commitment to this noble effort.

In short, the success of the Contracts Compliance Program depends upon you individually.

* * * * *

Army Seeking R&D MOBDES Officers

A new career program for research and development reserve officers has been announced by the Army. Approximately 767 positions throughout the Army are available for Mobilization Designees (MOBDES) who want to work in research and development. Designees train two weeks each year in their assigned position, preparing to perform full time in the event of mobilization.

Qualifications include experience or education in research and development. Additional information may be obtained by writing to the Office of the Chief of Research and Development, Washington, D.C. 20310.

Applications for research and development positions should be submitted to the Commanding Officer, U.S. Army Administration Center (USAAC), Attention: AGUZ-RA-SM, 9700 Page Boulevard, St. Louis, Mo. 63132, on DA Form 2976, Applications for Mobilization Designation Assignment. Form 2976 is available from Army Headquarters, Army Reserve Centers, or USAAC.

"Fly-by-Wire" for Aircraft Tested for USAF

A device which may replace a pilot's control wheel in future aircraft is being tested by the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio. Called a dual sidearm controller, it is currently being tested in a variable stability B-26 aircraft, programmed to simulate the flight characteristics of a B-1 aircraft.

Dual sidearm controllers are built into the co-pilot's seat frame, and are designed expressly for a fly-by-wire (electrical) flight control system employing heavy augmentation. The controls are worked by either or both of the pilot's hands, and control up-and-down and right-and-left movement. They are similar to a pilot's control stick.

The device was developed by Hughes Aircraft Co., and is being tested by Cornell Aeronautical Laboratory, Inc. David Frearson is the laboratory's project engineer for the dual sidearm controller.

"Matters of great public Import may be committed to the Sole care of these Men"

James E. Casey

The objective of Defense Department personnel security policies is to protect national security interests, with due regard to the rights of individuals. DOD seeks to achieve this objective by assuring the trustworthiness of individuals who are to have access to classified defense information or who perform sensitive duties in the defense organizational structure. Individuals affected by these policies are all military personnel, DOD civilian employees occupying sensitive positions, and defense contractor employees who require access to classified defense information.

The first personnel security screening program in the United States probably was that started during the Revolutionary War by General George Washington, when he formed a personal guard. On April 30, 1777, he wrote to Colonel Alexander Spotswood, in part:

> "Sir: I want to form a Company for my Guard. In doing this I wish to be extremely cautious; because it is more than probable, that in the Course of the Campaign, my Baggage, Papers, and other Matters of great public Import, may be committed to the Sole care of these Men. . . . When I recommend care in your Choice, I would be understood to mean Men of good Character in the Regiment, that possess the pride of appearing clean and Soldierlike. I am satisfied that there can be no absolute security for the fidelity of this Class of people, but yet I think it most likely to be found in those who have Family Connections in the Country. . . ."

Today, "Matters of great public import" are committed to the care of people in Government and industry. While "there can be no absolute security for the fidelity of this Class of people," trustworthiness is still evidenced by a person's character and behavior in the community.

Policy for safeguarding classified defense information in the Federal Government is based on Executive Order 10501, "Safeguarding Official Information in the Interests of the Defense of the United States," issued on Nov. 5, 1953. Section 7 of the order states "knowledge or possession of classified defense information shall be permitted only to persons whose official duties require such access in the interests of promoting national defense and only if they have been determined to be trustworthy."

Government Employees

Congress recognized the role of people in assuring the security interests of the Federal Government when it passed the Hatch Act on Aug. 2, 1939. The original Section 9A of that Act barred government employees from "membership in any political party or organization which advocates the overthrow of our constitutional form of government in the United States."

On Aug. 26, 1950, the 81st Congress enacted Public Law 733, which authorized the heads of 11 Federal agencies, including the Secretary of Defense and the Secretaries of the Military Departments, to remove civilian employees from their employment in the interests of national security, without following Civil Service Commission procedures. However, the Act provides that a U.S. citizen employee, who has a permanent or indefinite Civil Service appointment and who has completed his probationary period, is entitled before removal to a written statement of the charges, a hearing, a review of the case by the head of the agency or his designee, and a written statement of the decision by the agency head.

Enactment of Public Law 733 was followed by Executive Order 10450, "Security Requirements for Government Employment," on April 27, 1953. It extended the authority of Public Law 733 to the heads of additional agencies not listed in the statute, established minimum investigative requirements for employment in the Federal Government, and provided a standard and procedure for assuring "that the employment and retention in employment of any civilian officer or employee within a department or agency is clearly consistent with the interests of national security."

Executive Order 10450 also set forth criteria for making determinations under the standard. These criteria include: behavior, activities, or associations which tend to show that the individual is not reliable or trustworthy; criminal conduct; drug addiction, excessive use of intoxicants; mental illness without evidence of cure; advocacy of the use of force or violence to overthrow the Government of the United States.

DOD Directive 5210.7, "Department of Defense Civilian Applicant and Employee Security Program," based on Executive Order 10450, was published on Aug. 12, 1953. The directive was reissued on Sept. 2, 1966, extending the hearing procedures contained on Public Law 733 to probationary employees.

DOD Directive 5210.7 defines a "sensitive position" as one in which the occupant could bring about a material adverse effect on the national security by virtue of the nature of the position. Hearing procedures and other administrative matters are set forth. Also, it provides that applicants being considered for sensitive positions should be given an opportunity, where appropriate, to explain or refute derogatory security information before being rejected on security grounds. The directive provides for coordination in certain matters with the Federal Bureau of Investigation and the Civil Service Commission.

On June 11, 1956, the Supreme Court decided the case of *Cole* v. *Young*, 351 U.S. 536, which held that, although the President had the power to establish sensitive positions in all agencies under Public Law 733, he did not have the authority to designate positions as sensitive unless they were affected by the national security.

Military Personnel

Executive Order 10450 triggered a similar personnel security program for military personnel. On April 7, 1954, DOD Directive 5210.9, "Military Personnel Security Program," was published, and was reissued on June 19, 1956. It provides the current policy guidance for the acceptance, retention, or separation of persons in the Armed Forces in the interests of national security. It contains the same standard and substantially the same criteria stated in Executive Order 10450.

Although there is no statutory authority similar to Public Law 733 for the military personnel security program, its legal basis can be sustained under the Constitutional power of the President as Commander in Chief of the Armed Forces, the National Security Act of 1947, and Title 10, U.S. Code. Further, the courts have consistently recognized the authority of the President to enforce discipline in the Armed Forces.

DOD Directive 5210.9 requires that all persons initially enlisted or inducted into the Armed Forces complete an "Armed Forces Security Questionnaire." Information from the questionnaire is the basis for a screening program, followed by interviews and investigation where necessary. Its purpose is to identify and preclude the entry of persons into the Armed Forces where acceptance would not be clearly consistent with the national security. Additionally, a National Agency Check is conducted on all Armed Forces personnel upon entry into military service.

No person may be rejected for military service for security reasons without being given an opportunity for a hearing. In some cases, individuals are assigned to specially controlled duties as a security measure, but indefinite assignment of this kind is prohibited, except as prescribed by the Secretary of the military department concerned.

Industrial Personnel

An industrial security program was initiated by the Government during World War II under the general authority of Executive Order 8972, issued on Dec. 12, 1941. In the following years, each military department conducted its own program. DOD Directive 5220.6, "Industrial Personnel Security Review Regulations," published on Feb. 2, 1955, established overall DOD policies for making security clearance determinations in contractor employee cases. It did not provide the applicant an opportunity to confront or cross-examine those furnishing adverse information about him.

This directive remained in effect until the *Greene* v. *McElroy* case, 360 U.S. 474 (1959), when the Supreme Court held that, in the absence of explicit authorization by the President or the Congress, the Secretaries of the Armed Forces had no authority to conduct an industrial security program which deprived contract employees the safeguards of confrontation and cross-examination of their accusers.

As a consequence of the *Greene* case, President Eisenhower issued Executive Order 10865, "Safeguarding Classified Information Within Industry," on Feb. 20, 1960. This order, as amended by Executive Order 10909 of Jan. 17, 1961, authorizes the Secretary of Defense and the heads of certain other agencies to establish programs for protecting classified information furnished to industry. Also, it provides that an authorization for access to classified information may be granted to an applicant only upon a finding that it is clearly consistent with the national interest to do so.

Further, and of great importance to the applicant, this executive order affords him "due process" before his access to classified defense information may be finally denied or revoked.

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He must be given a written statement of the reasons for denial or revocation of access, an opportunity to respond in writing, a personal appearance proceeding, and reasonable time to prepare for his appearance. He may be represented by counsel, and cross-examine witnesses. He must be given written notice of the decision in his case, setting forth the finding on each allegation in the statement of reasons.

The publication of Executive Order 10865 was followed by the reissuance of DOD Directive 5220.6 on July 28, 1960. It established procedural guidance for processing personnel security cases. No criteria for making determinations were provided by Executive Order 10865; therefore, the criteria published in Executive Order 10450 were adopted for industrial security cases. DOD Directive 5220.6 was again reissued on Dec. 7, 1966, under the title, "Industrial Personnel Security Clearance Program." The major change was decentralization of final determinations to hearing examiners, subject to appeal to the Appeal Board in the Pentagon.

Approximately 2.3 million employees in 13,500 contractor facilities are affected by the Defense Department Industrial Security Program. Nearly all security clearances were granted upon receipt of investigative results without appeal proceedings under the provisions of DOD Directive 5220.6. In 1969, 1,016 appeal cases were processed under that directive. Of these 454 resulted in issuance of clearance, 247 resulted in denial of clearance, and 315 were not processed to a conclusion because of a change in applicant's employment or for administrative reasons.

Investigations

All personnel security programs discussed in this article are screening programs to evaluate trustworthiness. They rely upon personnel security investigations. Generally speaking, the minimum investigation upon which a security clearance is determined is a National Agency Check. It includes checks of the subversive and criminal files of the Federal Bureau of Investigation, and such other national agencies which may have records on the applicant. In a substantial number o cases, an expanded investigation is conducted to resolve or clarify unfavorable information and may include a personal interview with the applicant.

A background investigation, or full field investigation as it is called by the Civil Service Commission, is required for Top Secret clearances, critical sensitive jobs in Federal employment, and certain other positions requiring access to highly sensitive information. It is designed to develop pertinent facts concerning the loyalty and trustworthiness of the applicant. A background investigation includes a National Agency Check. In addition, it includes inquiries about education, employment, military service, credit rating, criminal records, citizenship, foreign travel and connections, and organizational affiliations. References and other individuals having knowledge of the applicants background are interviewed. Inquiries are *not* directed to applicant's religious beliefs, racial matters, political activities other than membership in subversive organizations, or his beliefs on constitutionality or wisdom of legislative policies.

Determinations

When investigation of the applicant is completed, results are furnished to the organization which requested it for a determination. In the vast majority of cases, this determination is a favorable one and is followed by clearance, employment in a sensitive position, or acceptance or retention in the Armed Forces.

The greatest care is given to making personnel security determinations. Applicants come from a great variety of environments. Deviations from the norms of human conduct vary in significance depending on the facts in each particular case. Evaluation of derogatory reports of personal conduct must be based on good judgment. Common sense must be applied in the ultimate determination, based upon *all* the information available.

Consideration must be given to such factors as the seriousness of derogatory conduct, its implications, its recency, the motivation for it. The degree to which such conduct was voluntary and undertaken with knowledge of the circumstances involved must be examined. To the extent that it can be estimated and is appropriate in a particular case, the probability that such conduct will continue in the future must also be estimated.

Relevant Court Decisions

No discussion of personnel security would be complete if it ignored the effect of court decisions and the constitutional signposts they have erected. The *Cole* and *Greene* cases have already been discussed. Others are:

- *Vitarelli* v. *Seaton*, 359 U.S. 535 (1959) established the rule that an agency, which removed an employee on security grounds, must follow its regulations for processing security cases, even though the employee could have been removed summarily without reasons being given.
- *Harmon* v. *Brucker*, 355 U.S. 579 (1958) held that a member of the Armed Forces was entitled to a discharge based upon the character of his military record.
- *Bland* v. *Connally*, 293 F2d 852 and *Davis* v. *Stahr*, 293 F2d 860, both decided on June 15, 1961, that an inactive reserve member of the Armed Forces may not be given less than an honorable discharge for alleged subversive conduct when he was not on active duty as a reservist.
- *Schneider* v. *Smith*, 390 U.S. 17 (1967) held that the Congress had not delegated authority to conduct a screening program to "ferret out the ideological strays in the maritime industry." The court observed that the statutes are to be read narrowly to avoid questions concerning "associational freedom" and other rights within the purview of the First Amendment to the Constitution.
- *Robel* v. *U.S.*, 389 U.S. 258 (1967) held the criminal provision of Section 5(a)(1)(D) of the Subversive Activities Control Act of 1950 to be unconstitutional because it exceeded the bounds imposed by the First Amendment to the U.S. Constitution. The Court observed: "We are not unmindful of the Congressional concern over the danger of sabotage and espionage in national defense industries, and nothing we hold today should be read to deny Congress the power under narrowly drawn legislation to keep from sensitive positions in defense facilities those who would use their positions to disrupt the Nation's production facilities . . . . while the Constitution protects against inva-

sions of individual rights, it does not withdraw from the Government the power to safeguard its vital interests."

- *Adams* v. *Laird*, decided by the United States Court of Appeals (District of Columbia) on Dec. 12, 1969, upheld the Defense Department in denying Mr. Adams a security clearance. The court reviewed the hearing proceedings and commented that the President had articulated a standard that classified information is to be made accessible to an applicant "only upon a finding that it is clearly consistent with the national interest to do so." It noted that this standard was adopted by DOD. The court approved the standard and the supporting criteria.[1]

The *Schneider* and *Robel* cases, in a large part, prompted the House of Representatives to pass H.R. 14864, on Jan. 29, 1970. This bill would amend the Internal Security Act of 1950 by adding a new Title IV "Defense Facilities and Industrial Security," which authorizes the President to establish an industrial security program similar to that now operated by the Defense Department, a "Defense Facilities" program for a select group of industrial facilities, and a port security program. The bill authorizes the President to provide for screening of personnel in support of these programs.

H.R. 14864 is an effort to modify the provisions of the Internal Security Act of 1950, to conform to the guidance furnished by the Supreme Court in the *Robel* and *Schneider* cases. Also, it would provide a statutory base for the DOD Industrial Security Program. The Senate Judiciary Committee now has H.R. 14864 under consideration.

In summary, personnel security is concerned with assuring that trustworthy persons are selected for military, government, civilian and contractor positions concerned with the national security. The policies of the Defense Department are based upon law, justifiable need, and concepts of fair play. Every effort is made to protect national security interests without unduly impinging on the individual freedoms guaranteed by the United States Constitution.

[1] *The applicant in this case has requested the Supreme Court to review his case but, at the time of this writing, no decision had been made on this request.*

Army Engineers Award Safeguard Site Contract

The largest contract in Army Corps of Engineers history was awarded for construction of Safeguard Ballistic Missile Defense System facilities near Grand Forks, N.D. The $137,858,850 contract was won by a four-firm joint venture of Morrison-Knudsen; Peter Kiewit Sons, Inc.; Fischbach and Moore; and C. H. Leavell. The contractor is authorized to subcontract 75 percent of the work.

Facilities of the installation include a Perimeter Acquisition Radar (PAR), which detects incoming ICBMs at 1,000-mile ranges and computes their trajectory. A Missile Site Radar (MSR), which takes information from the PAR 23 miles away, launches and guides Spartan and Sprint missiles.

PAR and MSR buildings will be as large as any built for DOD. The MSR building, partially buried, will be hardened and will contain shock isolation devices for the computers and other equipment. The PAR building, although above ground, will be hardened also. Supporting and utility systems will have both redundancy and reserve capabilities.

Separate diesel power plants for the MSR and PAR sites will be large enough to power a city of 25,000 people. They will be hardened, shock isolated and underground.

Missiles will be placed underground in reinforced concrete silos.

Initial work at the sites includes grubbing, grading, building bituminous roads, installation of utilities, and fencing. Expected work force is 300 by June and 1,700 by August. All work is scheduled to be completed by mid-1973.

The Huntsville, Ala., Division of the Corps of Engineers is responsible for design and construction of Safeguard facilities.

"DSA—An Introduction" Available from GPO

The who, what, why and where of the Defense Supply Agency is told in the newly revised edition of "An Introduction to the Defense Supply Agency."

The 46-page, digest-size book includes a brief look at DSA's scope of operations, organization and key personnel. The major portion of the booklet consists of short descriptions of the DSA supply centers and categories of procurement, depots, materiel distribution system, service centers, and defense contract administration regions.

Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, the price is 35¢. The order number is D7.2:d36/970.

AIM–82 Definition Contractors Selected

The Air Force has selected three contractors to further define the AIM–82 short range tactical air-to-air missile. The three system definition contractors are: General Dynamics Corp., Pomona Division, Pomona, Calif.; Hughes Aircraft Co., Missile System Division, Canoga Park, Calif.; and Philco-Ford Corp., Aeronautics Division, Newport Beach, Calif. Each contractor has been funded approximately $1.5 million.

Since the Navy also has a requirement for a similar new missile, the next step in the AIM–82 program will depend on a decision by the Secretary of Defense on how best to provide a new air-to-air missile for both the Air Force and Navy.

If approved for production, it will be used in the F–15 and F–14, and in other aircraft such as the F–4, A–6, A–7 and F–111. It is planned for use in the rapidly maneuvering "dogfight" role.

The AIM–82 missile program is directed by the Deputy for the F–15, Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, Ohio.

FROM THE SPEAKERS ROSTRUM

FY 1971 Research, Development, Test and Evaluation, Army

Excerpts from statement by Lt. Gen. Austin W. Betts, USA, Chief of Research and Development, Department of the Army, before Subcommittee No. 3 (Research and Development) of the House of Representatives Committee on Armed Services.

Our FY 1971 budget request [for the Army Research, Development, Test and Evaluation (RDT&E) Program] of $1.7 billion is based on providing the equipment, material and techniques necessary to meet both the present and future threats to national security. . . .

. . . Air mobility is our first priority for research and development effort in the Army. Our primary effort in this area is directed toward the development of an attack helicopter. . . .

The Army's second priority for research and development effort is for intelligence acquisition and dissemination systems. . . . The Army has established a dedicated STANO Management System and appointed a STANO Systems Manager. STANO is an acronym for Surveillance Target Acquisition and Night Observation and is comprised of those means and materials organic to or in support of the Army in the field associated with information gathering and presentation capabilities used to find the enemy or facilitate night operations. . . . The type of devices included in the program are ground and aerial night vision devices, radars, special purpose detectors, optical and aural devices, unattended ground sensors and electronic warfare support devices. . . .

The annual research, development, test and evaluation, Army, budget request to Congress is divided into the eight Budget Programs.

Military Sciences

Budget Program 5000, Military Sciences, supports research and exploratory development in the physical, engineering, environmental, and medical sciences, as well as work related to Army manpower resources. . . .

Among the strong reasons for continued Army research and exploratory development are maintenance of:

- Continuity of effort required to conceive and develop the advanced weapon systems needed by the Army.
- Competent in-house staffs that can direct, monitor and assess the performance of basic and applied research contractors.
- Capability (experienced in both research and Army materiel development) to improve existing operational weapon systems.

[An] example is our materials research effort. We have been working on improved lightweight armor for some time, with recent success. Tests of this recently developed plastic material compared with that of other lightweight armor materials, such as nylon, doron, steel and titanium, show great promise. For an equal weight of armor, this new material permitted fewer penetrations by shell fragments than the best materials currently being used. We are developing a production base for this new material and incorporating it into an advanced lightweight armor design.

. . . We hope to improve and exploit this property in providing armor for helicopter windshields and armored vehicle viewing ports.

We are also developing a sapphire transparent ceramic material that can defeat .30 and .50 caliber AP projectiles. This material could be used in portholes and windshields of armor vehicles to provide a protected observation means for the crew and passengers.

Aircraft

Budget Program 5100 provides for development of aircraft and related equipment. To maintain a viable, effective organic battlefield movement capability, the Army considers air mobility as the number one research

Research, Development, Test and Evaluation Army

(Dollars in Thousands)

Budget Programs		FY 1970	FY 1971
5000	Military Sciences	162,683	176,200
5100	Aircraft	94,777	110,200
5200	Missiles	853,430	896,400
5300	Military Astronautics	9,300	10,700
5400	Ships, Small Craft	400	1,100
5500	Ordnance, Combat Vehicles	153,412	153,200
5600	Other Equipment	304,318	317,800
5700	Program Wide Mgmt Spt	51,500	52,300
	Total RDT&E Program	1,629,820	1,717,900

and development priority effort in the Army today.

The following priorities have been established for major aircraft systems:

1. Gunships.
2. Heavy lift helicopter.
3. Utility tactical transport aircraft system.
4. Manned aerial vehicle for surveillance.
5. Light tactical transport aircraft system.

The attack helicopter development program continues to be our number one priority. It is a part of the evolutionary concept of using an aerial platform for close support and anti-tank missions. The high priority of the gunship is based on the need to improve the responsiveness and increase the capability of air vehicles in providing close fire support to our maneuver units. . . .

As an example of our increasing research and development support to aviation, we are increasing emphasis on aviation technology and have a new program titled Advanced Helicopter Development. . . . We plan a broad technology program encompassing the design and demonstration of new concepts in rotors, innovations in rotary wing aircraft designs and maintainability and reliability. We require a rotary wing technology base equivalent to that of fixed wing aircraft. . . .

We have made excellent progress in solving the technical problems in the rotor control system that forced us to terminate the AH–56A production contract last year. We were assisted by the nation's foremost authorities in the helicopter field in this effort and we now know enough about the rotor system to solve the problem. Lockheed is well along in initial testing and final verification is expected in FY 71. The most significant progress on AH–56A has been in the armament and fire control subsystems testing. . . .

Missiles

The largest single line item in Budget Program 5200 is the Safeguard Defense System. . . .

. . . an advanced development program totalling $158 million is requested in FY 1971 for the Advanced Ballistic Missile Defense Program Element.

SAM–D is an advanced development program to prove the feasibility of advanced technological concepts that will lead toward the most cost effective replacement for Hercules and Improved Hawk.

. . . In November last year we successfully demonstrated the feasibility of launching the SAM–D missile from its shipping container. During the coming year, integration and testing of the hardware will be conducted. Limited engineering development will be initiated which will be a deliberate design definition to remove any over design features and reduce cost and complexity without degrading the system's capability to counter the threat. . . .

Lance is being developed to provide nuclear fires in support of the field army and is a replacement for both the aging Sergeant and Honest John systems.

. . . The decision has been made to field the Lance missile system with the new rocket engine (5-ring engine) . . . . The nuclear warhead is scheduled for production. Development of a non-nuclear warhead is continuing. A decision on the fielding of this non-nuclear capability will be made later this year.

Military Astronautics

Budget Program 5300, Military Astronautics and Related Equipment, supports the development of ground terminals and related equipment for space systems. The Army participates in space programs along with the Navy, Air Force and NASA and most of our work in this budget program is for the Defense Satellite Communications System.

Ship, Small Craft

Budget Program 5400 has the objective of modernizing Army peculiar marine craft and amphibious lighters used for ship-to-shore logistics operations. The program consists of developing: an improved Beach Discharge Lighter, and a Small Harbor and Inland Waterway Tug.

The increase in FY 1971 funds Beach Discharge Lighter improvements required as a result of combat evaluations in Vietnam. All work is done in conjunction with the Navy to avoid duplication of effort and with maximum utilization of commercially available equipment.

Ordnance, Combat Vehicles

Budget Program 5500 covers Ordnance, Combat Vehicles and Related Equipment.

By direction of the Deputy Secretary of Defense and in response to Congressional guidance, the Army has again reviewed the original design of [the Main Battle Tank] MBT–70 in detail to identify a more austere tank which could be available in the same time frame and at less cost to meet the Soviet mechanized threat of the 1970s. . . . A revised program requiring $36 million in RDT&E funds for FY 71 to pursue this revised configuration was recommended to the Deputy Secretary of Defense . . . and received his approval. The new program will delay first production from July to December 1975 and impose more stringent milestones along the way. . . .

Testing of the prototypes has confirmed the expectation of superior performance obtained from the combination of high horsepower, improved suspension system, and better driver location. . . .

In response to Congressional guidance concerning the application of the Shillelagh missile to the infantry and heliborne roles, we have expedited our evaluation and review of the recently received Philco-Ford detailed proposals for feasibility and development programs for both infantry and heliborne Shillelagh systems. Upon completion of this review, approval of a $5 million reprogramming action, and with Congressional approval, we are prepared to pursue a 6- to 8-month, infantry mode, feasibility demonstration program to answer such questions as:

- Can the problems of crew safety, launch transients, required lightweight electronics, and accuracy be overcome?
- Can these problems be solved without major missile modifications which preclude interchangeability between armored and infantry versions?
- Will the modified missile and associated ground support equipment result in overall reductions in cost?

• Will the time required before production and the end results of the developmental program meet operational requirements that are currently met by the TOW missile?

Other Equipment

Budget Program 5600, Other Equipment, covers a broad range of items of communications-electronics equipment.

Using a total system engineering approach, the Mallard program will provide for full operability of all of the functional elements of the tactical communication systems. A building block design concept will be used to provide the flexibility required to configure the system to the specific needs of the military forces and permit us to buy only the quantity of equipment needed for a given force structure.

The system is now entering the advanced development phase of research and development. In FY 1971, through the use of models and simulation, we plan to verify the correctness of previous technical conclusions, prepare specifications for engineering development and determine detailed, joint operational and quantitative requirements.

As a result of the President's policy statements of Nov. 25, 1969 and Feb. 14, 1970, the chemical and biological programs have been reoriented. All offensive biological work and all toxin work have been eliminated. The Chemical Warfare Program and the remainder of the Biological Research Program have been restructured. . . .

The Chemical Warfare Program emphasizes both the development of adequate defenses and a retaliatory offensive lethal and incapacitating agent capability. The defensive aspects of our chemical warfare program constitute better than half of our research and development effort since the Soviets are known to have large stockpiles of chemical agents and weapons. . . .

The Biological Research Program consists solely of research and development for a defensive capability against both toxins and germ warfare.

Examples of chemical warfare programs are the Modular Collective Protection System and the Binary Lethal Weapons System. This binary technology will eliminate the inherent problems of production, storage, transportation and handling of lethal chemicals. The binary technique of generating lethal agent consists simply of combining nontoxic materials within the ammunition at the time of employment, to form lethal agents of either the G-series or V-series.

Program-wide Management Support

Budget Program 5700, Program-wide Management and Support, provides for that portion of the research and development in-house effort that cannot logically be funded to a specific project in one of the other budget activities.

The major portion of this budget activity provides for research and development personnel, cost, travel and other applicable administrative expenses for the performance of research and development functions at major headquarters below Department of the Army level. Also included are the costs for the operation, management and maintenance of general purpose research, development, test, and evaluation facilities and activities which cannot be distributed to specific elements. This element is primarily a fixed cost item. Our FY 1971 request is for $52.3 million.

FY 1971 Research, Development, Test and Evaluation, Navy

Excerpts from statement by Robert A. Frosch, Asst. Secretary of the Navy (Research and Development), before the Senate Committee on Armed Services.

Research and Exploratory Development

There are two elements in the Research program. One is for In-House Laboratory Independent Research performed by our Navy laboratories, and the second element is for Defense Research Sciences. The In-House Laboratory Independent Research Program maintains for the Navy an in-house capability of assessing and advancing technologies critical to our military missions.

Seventeen patents were issued in FY 1969 for ideas developed under this program, and 10 additional applications for patents were submitted and are currently under review. Items included among the patents are an instrument for measuring absolute reflectance and transmittance at cryogenic temperatures, explosive welding, electrochemical cells for thermal batteries, a method of tempering unique specialty (martensitic type) alloys, and a polarized light reflectometer for improved infrared detectors.

The Defense Research Sciences Program supports research in the important physical, engineering, environmental, biomedical and behavioral sciences areas. This program is performed by the Navy laboratories and by university and industrial scientists. These efforts are carefully planned to generate new knowledge in those scientific disciplines that will contribute to improvements in naval options and capabilities.

In this regard, Section 203, Public Law 91–121, provides that none of the funds authorized may be used to carry out any research project or study unless such project or study has a direct and apparent relationship to a specific military function or operation. . . .

Some of our objectives and recent accomplishment of this research under Defense Research Sciences follow:

• Special plasticizer additives resulting in more powerful solid and liquid propellants; decreased radar interference caused by solid rocket motor exhaust; new batteries for meeting special Navy needs; and a

unique system for closed cycle production of electricity.

• The first large scale refrigerator to operate continuously below minus 457° F., an advance of prime importance to highly efficient, compact and reliable electronic systems for future use aboard ship and other weapons platforms.

• Completion of simulations of a wide variety of alternative inventory policies for the Polaris weapon system resulting in major reductions of inventory investments while maintaining current levels of effectiveness.

• Clarification of our understanding of structural stresses and characteristics associated with brittle failure in naval pressure vessels.

• Recent completion of the interagency cooperative Project TEKTITE I producing important data about man's psychological reaction to long duration (60 days) in an underseas habitat.

• The definition of environmental parameters within which Navy and Marine Corps personnel can function efficiently; improvement of methods for the diagnosis, treatment, and prevention of disease in combat areas; and prevention of biological deterioration of equipment and materials.

• Navy Arctic Research Laboratory at Point Barrow, Alaska, was developed to meet the growing importance of the Arctic to the Navy and the nation. The laboratory supports research in the Arctic Ocean and operates ice island research sites. The program emphasizes oceanography, underwater sound, sea ice, environmental conditions, and techniques of military construction on permafrost.

• The collection, at all depths and for extended periods by means of self-contained instrument capsules, of ocean current velocity, temperature and pressure data required for understanding long range sound propagation.

A significant portion of the Defense Research Sciences element, approximately 29 percent, supports the Navy's Oceanographic Research Program. . . . Research emphasis has increased in these areas which relate to acoustics, lasers, ultrasensitive instruments, high temperature materials, logistics, large scale integration of electronic circuitry, automatic digital communications systems, deep submergence, energy conversion, and human performance in the ocean environment.

The Defense Research Sciences element also provides funds to continue certain programs originally started in support of the DOD University Program (Project THEMIS). The THEMIS program will not be identified separately in FY 1971 and subsequent years. . . .

Research, Development, Test and Evaluation, Navy Program, by DOD Categories

($ Millions)

	FY 1969	FY 1970	FY 1971
Research	130.3	117.9	118.9
Exploratory Development	262.1	236.1	242.9
Advanced Development	296.7	280.8	347.3
Engineering Development	346.0	392.5	531.9
Management & Support	228.0	229.7	226.1
Operational Systems Development	928.4	942.6	730.2
TOTALS	2,191.5	2,199.6	2,197.3

Exploratory Development

. . . Some examples of this work include: In the field of vehicles, wind tunnel tests on a reversed velocity rotor are expected to confirm an anticipated possible increase in helicopter forward speeds. Silencing studies on submarines are leading to developments which may make the submarine less detectable by enemy sonars, active or passive. The application of solid state electronics promises an improvement in the reliability of aircraft electrical systems while reducing the total volume and weight.

Under the Command and Control Programs, the development of functional building blocks for the Advanced Avionic Digital Computer will provide design flexibility needed by the various operational avionics requirements projected for the 1975–1985 time frame. Work is progressing on computer mass memories using ferro-acoustic and plated film techniques which, in the next three to five years, should produce low cost and high density memories, which will be many times improved over that now available. In an additional 5 to 10 years, using electron optic techniques, we should see memory block densities of 50 million bits per square inch. . . .

Among developments for the Marine Corps are an ultra-lightweight HF transceiver and techniques of battlefield surveillance and detection. Also sought are improved swimmer propulsion units and cold water exposure suits, as well as terminally guided ground-based missiles.

In the Weaponry area, we are developing new propulsion systems for torpedoes. Methods of improving our ability to distinguish real from false targets and selecting from multiple targets are being pursued. Technology to support a light, all-weather missile system will be developed so that small craft can improve their self defense/offense capability.

In the Support area, we are developing technology to measure and predict the environment (the atmosphere, the oceans, and the nuclear warfare environment) to support Navy operations. . . . Deep ocean engineering studies will stress the development of techniques, tools and equipment for emplacing fixed structures on the ocean bottom. Techniques are being developed to prevent deterioration by water exposure of glass reinforced plastic so that it may be better used for pressure hulls.

Development efforts are being conducted in many other areas such as nuclear propulsion and shielding, satellites, surveillance, life sciences, deep search and retrieval, HY 180 steels and other materials for construction.

Management and Support

Management and Technical Support programs will be carried out in FY

1971 in the areas of antisubmarine warfare and strategic warfare.

We will pursue several smaller programs in FY 1971 including such programs as Missile Flight Evaluation Systems, Technical Information Centers and Mutual Weapons Development.

Air Warfare

. . . We have included three hardware groupings under this objective; Aircraft and Related Equipments, Air-Launched Missiles, and Air-Launched Ordnance.

. . . The major goals of our programs are: to improve our fleet-air-defense and air-to-air combat through more effective aircraft, acquisition and fire control systems, air-to-air missiles, and airborne early warning, command and control capabilities; and to enhance our offensive airstrike capability through decreased weapon delivery error (CEPs), increased weapons release stand-off range, improved airborne reconnaissance, and expanded night and all-weather attack.

The major *Aircraft and Related Equipment* programs are: the F–14A, E–2C, EA–6B and HXC (Heavy Lift Helo) aircraft; F–14B Advanced Technology Engine, and Airborne Integrated Reconnaissance System (AIRS).

. . . FY 71 funds will provide for first flight and initiation of Navy preliminary evaluation of the F–14A aircraft and its weapon system.

. . . FY 71 funds will provide for flight testing of two system prototype E–2C aircraft and continued engineering testing of the active elements of the integrated avionics equipments.

. . . FY 71 funds will allow completion of operational evaluation [of the EA–6B] and the continued development of this advanced early warning aircraft.

The HXC Helo is to be a crane-configured helicopter intended to lift 18-ton loads. . . . FY 71 funds will provide detail design completion, initiation of ground testing and evaluation.

Advanced engine technology for the F–14B is for the purpose of maximizing the F–14's air superiority fighter capability. The new engine will have approximately 40 percent more thrust and 25 percent less weight than the TF–30 engine in the F–14A. . . . FY 71 funds will provide for the continued progress in engine development and engineering design necessary for transition from the F–14A to the F–14B. . . .

The Airborne Integrated Reconnaissance System (AIRS) will provide fleet commanders with necessary real-time reconnaissance information. It is planned to engineer this system into the F–14 aircraft to provide an RF–14 as the Navy's next generation reconnaissance aircraft. . . .

The principal *Air-Launched Missile* programs are: the Harpoon Anti-Ship Missile; Condor and Bulldog Air-to-Ground Missiles; Phoenix and Agile Air-to-Air Missiles; and the Standard ARM Anti-Radiation Missile.

. . . FY 71 funds [for the Harpoon] will permit completion of the critical field experiments, test of the basic weapon concept, elements of contract definition, selection of a development contractor and initiation of engineering development. . . .

The Condor is to be an air-to-surface missile with an electro-optical (TV) guidance system. . . . We are considering a revised plan where we would continue the Condor in RDT&E phase to conduct a thorough system technical/tactical evaluation with research and development missiles to optimize system characteristics and configuration before committing the Condor to production.

The Bulldog close air support air-to-surface missile is an inventory Bullpup missile modified for use as an accurate weapon intended primarily for use by the Marine Corps. . . . FY 71 funds will provide engineering development, contractor demonstration and commencement of operational evaluation.

The Phoenix missile system will provide the F–14 aircraft with its primary fleet air defense capability. The Phoenix missile control system (AWG–9) will be capable of controlling other missiles as well, *i.e.*, Sparrow, Sidewinder, and Agile, and the M–61 Gun. . . .

Agile is a proposed passive, short range air-to-air missile. . . . FY 71 funds will allow concept formulation and advanced development to continue. Engineering development is planned to commence as soon as hardware, tests and evaluations have confirmed that the missile desired can be engineered with high confidence.

Standard ARM is an anti-radiation missile to provide strike forces with a capability to destroy surface-to-air missile sites and Ground Control Intercept (GCI) radars. This program has recently undergone a thorough review in the Navy and the program is now directed toward development of improvements in the missile and modification of the APS–118 Target Identification and Acquisition System (TIAS) to improve its compatibility with the A–6 weapon delivery system at a somewhat lower cost. . . .

The predominant *Air Launched Ordnance* programs are: Conventional Ordnance Development; Unguided Conventional Air-Launched Weapons; and Aircraft Ordnance Safety.

FY 1971 Research, Development, Test and Evaluation, Navy Program, by Budget Activities

($ Millions)

	FY 1970	FY 1971
Military Sciences	139.3	142.2
Aircraft & Related Equipment	794.9	693.9
Missiles & Related Equipment	458.7	494.3
Military Astronautics	19.1	29.1
Ships, Small Craft & Related Equipment	296.3	377.7
Ordnance, Combat Vehicles and Related Equipment	100.4	89.0
Other Equipment	242.2	226.5
Program-wide Management & Support	148.7	144.6
TOTALS	2,199.6	2,197.3

The *Conventional Ordnance Development* program effort is directed toward development of an Anti-Personnel/Anti-Material (AP/AM) cluster weapon, an Incendiary Bomblet, improvement of our General Purpose Bomb, and a Lightweight 20mm Gun Pod. The AP/AM weapon is designed for use with the Rockeye dispenser. . . . FY 71 funds will allow continued engineering development and evaluation of prototype hardware which will lead to initiation of operational evaluation. The Incendiary Bomblet will also be packaged in the Rockeye dispenser. FY 71 funds will allow completion of bomblet and fuze designs and fabrication of development models for testing. Improvements of the General Purpose Bomb will investigate in-flight options, and increased cook-off time. FY 71 funds will allow completion of system effectiveness studies and initiation of advanced development of the bomb case design. The Lightweight 20mm Gun Pod is intended for use on helicopters and light attack aircraft. An aircraft pod is under development to house an inventory MK-12 20mm aircraft gun and ammunition. FY 71 funds will provide for initiation of engineering development and test development hardware of the XM-197, 3-barrel gun in a suitable lightweight pod.

The *Unguided Conventional Air-Launched Weapons* program contains four development projects in FY 71. The Multi-Purpose 20mm Round is aimed at developing a suitable 20mm round for joint service use and to provide improved penetration and fragmentation. . . . FY 71 funds will complete engineering development. Deneye is a project to develop air droppable anti-vehicle and anti-personnel mines. . . . FY 71 funds will continue engineering development leading to operational evaluation. Zap is a hypervelocity cluster-warhead aircraft rocket primarily used for flak suppression and vehicle destruction. It is expected to replace the 2.75 and Zuni rockets. FY 71 funds will support optimized general purpose warhead design and improvements in motor, pod and fins for cost reduction. The Fuel Air Explosive Weapon (FAE) is a weapon that maximizes the blast. The low speed delivery weapon has completed development. FY 71 funds will allow continued development to improve the high speed delivery capabilities.

Surface Warfare

. . . New weapons include area and point defense missile systems, as well as new gun ordnance. New hull types and new propulsion principles will be brought forward so that our new ships will embody the advantages of advancements in shipbuilding technology.

We are commencing the engineering development of the Advanced Surface Missile System in FY 1970. This system, now called Aegis, will include a combined antiair warfare/antisubmarine warfare (AAW/ASW) guided missile launching system and a modification of the existing Standard missile. Aegis is being developed primarily for installation aboard new ships that will join the Fleet in late FY 76 and beyond. . . . In FY 1971 we will move forward with the design and fabrication of the engineering development models to be installed aboard [the USS Norton Sound] test ship.

. . . We plan RDT&E effort in FY 1971 to upgrade the [Terrier, Tartar and Talos missile] systems to combat the increasingly severe threats such as the anti-ship missiles of the Soviet bloc.

In the *Combined AAW/ASW Guided Missile Launching System* MK 26 program in FY 71, we expect to finish most of the work on the construction of two prototypes of this launcher.

The objective of the *Point Defense Systems Development* program is the development of the Improved Point Defense Surface Missile System. . . . The improved system consists of all new equipment except the Sparrow missile. . . .

The components of the improved system are being developed under two projects: the new lightweight launcher, digital fire control system, and modification of the Sparrow missile will be produced by the NATO SeaSparrow Cooperative Development project. The Target Acquisition System and its integration with NATO SeaSparrow will be supported by the Point Defense Improvements project.

Both projects began engineering development in FY 70 and will continue into FY 71.

The Close-in Weapon System Project Phalanx, initiated in FY 70, should provide a self contained rapid reaction lightweight system capable of providing for a last ditch self defense against anti-ship missiles.

Conventional Ordnance Equipment supports engineering development effort leading to improved gun systems, fire control systems, rockets for gunfire support and antiship missile protection. We have delivered to the Fleet the 5" /38 Rocket Assisted Projectile (RAP) which increases the effective range of our present guns. Technical evaluation of the 5"/54 RAP is now underway.

The Bombardment Rocket will complete development effort. The 5"/54 Lightweight Gun (LWG) and the MK 86 Gunfire Control System are undergoing concurrent evaluation aboard the USS Norton Sound.

The Long Range Bombardment Ammunition project will complete technical evaluation in FY 70. This project utilizes subcaliber projectiles in 8-inch bag guns as a means of extending ranges.

The Major Caliber Lightweight Gun prototype as a 175mm gun will undergo firing tests. Requirements have been revised to provide that the production version of the MCLWG will be an 8-inch gun. This gun will be capable of firing conventional projectiles. The design work for a new projectile will commence in FY 71. The gun will also be capable of firing the existing inventory of 8-inch projectiles. The MCLWG will utilize the same MK 86 GFCS as the 5"/54 LWG.

Our effort in FY 71 will be continued development of the Major Caliber Lightweight Gun, and completion of evaluation of the 5"/54 MK 45 LWG.

Joint development of the marine Inertial Navigation System by the United States and the Federal Republic of Germany will be completed with the delivery to Germany of one unit and a production data package. The U.S. will continue the program to provide an automatic position update to the system. Evaluation of a system interface with NAVSAT and OMEGA will be started in FY 71.

FY 71 efforts in Night Surveillance Equipment will be directed toward the development and testing of a Shipboard Imaging System and Low

Light Level TV Systems. Development of Stabilization and Dual Magnification of Direct View Devices is continuing in FY 70.

The AIMS program is a tri-service project to provide IFF and Air Traffic Control for use by the military with integration with the FAA systems. Implementation of the system to meet FAA requirements will be completed by January 1973.

The development effort aimed at large multithousand-ton Surface Effect Ships in FY 71 has become primarily a Navy oriented program due to reduced participation of the Department of Commerce.

Strategic Warfare

. . . We have only one functional area [in Strategic Warfare], Sea-Based Strategic Systems, which includes all of the RDT&E, Navy, programs covering this mission objective. Fleet Ballistic Missile Systems, Fleet Ballistic Missile Command and Control and the Undersea Long-Range Missile System (ULMS) are some continuing major programs. Major increases in FY 71 include ULMS engineering studies and nuclear-powered ballistic missile submarine (SSBN) defense; decreases are in Fleet Ballistic Missile Systems modifications.

Other programs included in our FY 1971 effort are SSBN Defense, Sea-based Ballistic Missile Intercept System (SABMIS), Strategic Systems Technical Support, and Navy coordination with the Air Force managed Advanced Ballistic Re-entry System (ABRES). In addition we are requesting funds for Navy support to the Army Safeguard Antiballistic Missile Test Target Program.

. . . The Poseidon Development program is continuing on schedule to support initial deployment in January 1971. . . .

The SSBN Defense Program is developing technology to insure the long term security of our SSBN force. In FY 70 we are undertaking the gathering of data to further assess areas of vulnerability which might affect the security of the Fleet Ballistic Missile Force. For FY 71, funds will support further development in this area.

Development of improvements in the ability of our Fleet Ballistic Missile Command and Control communications network to survive nuclear attack continues. A higher power transmitter for the airborne VLF relay system, TACAMO, will complete feasibility demonstrations in March 1970. Construction of a Sanguine test facility in northern Wisconsin is complete. This test facility will primarily seek to demonstrate effective and economic ways of mitigating the interference effects of the extremely low frequency (ELF) system on the utility systems in the area as well as confirm propagation predictions. Research will also continue on ELF effects on the ecology as well as potential physiological hazards to man. . . .

We are continuing to develop the Undersea Long-Range Missile System (ULMS). In FY 1971 we plan to complete the preliminary ship design.

The Sea-Based Ballistic Missile Intercept System (SABMIS) concept, which is under study, might provide early detection and intercept of missiles far from the continental United States and thus possibly provide, with the Safeguard system, a defense-in-depth against ICBMs.

In FY 1971 for Anti-Ballistic Missile Support we are to configure excess, no longer deployed, Polaris missiles as targets in support of the Army Safeguard Program. Continued Navy support of this Army program is anticipated through the end of FY 1973.

Antisubmarine Warfare

Our emphasis in antisubmarine warfare (ASW) research and development systems for FY 71, exclusive of research and exploratory development, is directed largely in two areas. The first is the development of the S-3A carrier-based aircraft. . . .

The second area of importance is the development of better acoustic sensors for all ASW platforms.

In order to obtain data necessary for developing future surveillance systems, we are engaged in the Long Range Acoustic Propagation Project (LRAPP). Under this project we will continue an experiment for collecting simultaneous acoustic and oceanographic data.

In order to improve the sensors of air ASW, the Navy has started development of Advanced Acoustic Search Sensor Systems. Primary efforts will be toward building on our new Jezebel capability to obtain an improved sonobuoy compatible with the present DIFAR processor.

In surface ship sonars we are planning near term improvements to the SQS-26 sonar. We are working toward entering contract definition for this improved variation of the SQS-26.

Our most important submarine sonar research and development program is the BQS-13 DNA development initiated in 1970. . . .

In anticipation of a still quieter threat in the late 1970s, we are studying an advanced sonar system for our new construction submarines of that period. This system, called New DD/New Sub Sonar, is planned as an integrated development of surface ship and submarine sonar systems in order to obtain maximum commonality.

In FY 71 the single largest ASW research and development effort, other than the S-3A and sensor systems, is the torpedo Mark 48. . . . We anticipate initiating procurement this fiscal year. Development of a dual ASW/Antiship version of this weapon will also continue.

Most of the remainder of our ASW research and development systems funding will be in countermeasures, command and control, and necessary ASW facilities and support including such facilities as AUTEC.

Marine Corps Programs

. . . The Marine Corps research and development program represents approximately one-half of one percent of the total DOD RDT&E budget request. . . .

Certain realignment of functions has been made which is expected to increase efficiency. For example, the Marine Corps FY 1971 research and development program places the Marine Corps exploratory development efforts under the technical management of the Chief of Naval Material. . . . In FY 71, then, although funding for Marine Corps exploratory development still appears under the two existing program elements, Marine Corps Weaponry and Vehicles Exploratory Development and Other Marine Corps Exploratory Development, the administration of these elements will rest with the Chief of

Naval Material. . . .

FY 1971 will see the completion of RDT&E funding for the LVTPX–12 family of amphibious vehicles.

The test program for the mine clearance version is scheduled for completion in FY 1971. In addition, production of the command and recovery versions will begin during FY 1971. Initial issue of the personnel carrier, recovery and command vehicles is scheduled for FY 1972 while the mine clearance version will be delivered to the Fleet Marine Force at a later date.

Advanced development will be initiated for the Position Location and Reporting System beginning in FY 1971. A feasibility study conducted under exploratory development will be completed in March 1970. This will be followed by procurement of brassboard hardware and the development of software for testing systems concepts.

The fabrication of a Service Test Model (STM) of the AN/TPQ–27 Radar System was initiated during FY 1970 for the Marine Direct Air Support System and a service evaluation will commence at that time.

. . . Studies currently proposed for FY 1971 range from Logistics Support Ashore for Sustained Operations, to Survivability of Troop/Cargo V/STOL Aircraft. The support provided by the Marine Corps Operational Analysis Group under the Center for Naval Analyses program element is closely related to the studies effort.

Navy Oceanographic Program

($ Millions)

	FY 1969	FY 1970	FY 1971
Research, Test, Development & Evaluations	120.4	109.9	96.8
Ship Construction, Navy	0	0	7.3
Military Construction	4.6	3.1	2.7
Other Procurement, Navy	31.1	28.2	14.6
Operations & Maintenance, Navy	78.6	82.8	79.0
Manpower, Navy	12.8	10.5	9.4
Procurement, Aircraft & Missiles, Navy	0.2	10.8	0.4
	247.7	245.3	210.2

Oceanography

Underwater sound continues to be an essential sensor technique in undersea warfare, and over half of the Navy *Ocean Science Program* continues to be devoted to further understanding the environment's influence on it. . . .

The ocean engineering and development effort is directed toward the goal of permitting the Navy to operate effectively anywhere in the oceans, at any depths, and anytime. Our major project to develop a Deep Submergence Rescue Vehicle is reaching fruition. . . .

We will continue to develop new structural and buoyancy materials, power, vehicle control, and life support systems and other equipments and systems required if we are to operate effectively anywhere in the oceans. Our Deep Ocean Technology project is the focus for these developments.

In the coming year, our biomedical research will continue to concentrate on the prevention and treatment of illness and injury of men below the sea's surface, and include techniques for the on-site treatment and evacuation of sick or injured divers.

We have restructured our planned efforts in the Man-In-The-Sea project since the aborted SEALAB III experiment of last year, increasing emphasis on safety and proceeding at a more deliberate pace to increased depths.

We are developing a system which will provide us with the capability of quickly surveying and producing navigational charts of militarily significant coast lines.

The National Oceanographic Instrumentation Center will be in its second year of operation. This center is funded, manned and managed by the Navy with policy guidance provided by a seven-member advisory board composed of representatives from DOD, Commerce, Interior, Transportation, NASA, National Science Foundation and the Smithsonian Institution.

Oceanographic operations in support of the Fleet will include continued hydrographic surveys. . . .

Ships in support of Polaris/Poseidon and Minuteman III will continue surveys resulting in charts derived for hundreds of thousands of track miles of data in the deep ocean and waters off the continental United States.

Oceanographic surveys in support of ASW will continue in the Atlantic and the Pacific. The USNS Wilkes . . . will become operational in late FY 1971 to replace the recently inactivated USS Rehoboth.

Cooperative surveys underway with Japan and Korea, and a third effort, with Norway, are about to commence. . . .

Recently delivered to Scripps Institution of Oceanography for use in Navy programs was the 245-foot, 2,100-ton R/V Melville (AGOR–14) which employs highly versatile cycloidal propellers for both propulsion and on-station maneuvering. Her sister ship, the R/V Knorr (AGOR–15) is currently completing construction and when delivered will be operated for the Navy by Woods Hole Oceanographic Institution.

Scheduled for delivery in 1971 as the final oceanographic research ship now under construction is the 3,000-ton catamaran-hull T–AGOR–16. This extremely stable platform will be used primarily by the Naval Research Laboratory in support of our underwater acoustics program.

The Navy budget contains a request for two of a new class of small (300-gross-ton) utility AGOR. . . .

Space

Under *Military Astronautics*, which term identifies the Navy Space Program, there are two major efforts in exploratory, advanced, engineering and operational development, which I would like to highlight.

In the *Satellite Communications Program* in FY 1971, we intend to expedite development of reliable shipboard communication terminals.

The *Satellite Navigation* effort is divided into two space-related tasks, Transit and Timation. . . .

. . . Four Transit and two Timation satellites are in orbit.

Timation II, launched by the USAF for the Navy late last year, replaced Timation I. The techniques developed in this program will be applicable to the Defense Satellite Navigation System (DNSS).

In the DNSS area, the Navy is assisting the Navigation Satellite Executive Steering Group (NAVSEG) in its efforts to define a Defense Satellite Navigation System by providing design information on the limitation of various navigation systems, delineating the extent to which Transit could be utilized, and developing system information which will describe the best utilization of the Timation ranging technique in a three-dimensional navigation system with near instantaneous fix capabilities. . . .

Electronic Warfare, Communications and Command and Control

The major effort in shipboard electronic warfare has been directed against the antiship missile. To this end, a Ship Anti-Missile Integrated Defense (SAMID) program has been established to integrate discrete systems into a total ship system responsive to the command and control organization. The Shortstop system, phase I of the Ship Advanced Electronic Warfare System (SAEWS) project will interface directly with the Naval Tactical Data System so that this important tactical information is immediately available to the force and ship decision makers.

The Big Look Improvement Program (BLIP) was completed in FY 70. This program provided for update and evaluation of advanced signal acquisition and precision direction finding systems. These advanced systems will have applications in follow-on aircraft to be developed under the TASES program, discussed next.

The Tactical Airborne Signal Exploitation System (TASES) program will provide for development of follow-on systems to replace current fleet EC-121M and EA-3B aircraft. . . .

Airborne Electronic Warfare Jamming and Deception efforts include development of improved electronic warfare countermeasures (ECM) systems for Navy attack, fighter and reconnaissance aircraft. . . .

Communications Traffic Management and System Control facilities, which are being developed, assembled and tested for installation in the USS Nimitz (CVAN-68), will consist of a Message Processing and Distribution System and a Facilities Control System. . . . Research and development efforts in HF Radio Digital Terminal Equipment are being initiated in engineering development to provide high data rate digital communication systems suitable for the long range transmission of data required for automated data system applications. In the UHF spectrum, work is ongoing for the fabrication and comprehensive testing of advanced development models of the Harpy System for tactical communications. Following the anticipated successful testing of these advanced development models onboard ship and in an aircraft, we plan to continue engineering development efforts in FY 1971 for the design and fabrication of equipments for fleet introduction and evaluation of the system.

The major emphasis of our development program for command and control is the exploitation of digital computer technology. . . . These command and control systems may be categorized functionally as real-time combat direction systems and related families of tactical command data and management information systems.

The *Command Data Systems* program in advanced development provides the technical base for the effective integration of new sensors and additional tactical functions into the Navy's combat direction systems. The initial prototype model of a new third generation family of shipboard computer modules, known as the AN/UYK-7(V) Digital Computer, was delivered to the Navy this year and is undergoing performance testing. We have also commenced developments in computer programming and the related software system necessary for the desired operational application and exploitation of the AN/UYK-7(V) processing system. This computer is now planned for data processing and control application in the LHA, DXG(N), SSN, and Aegis Missile Programs.

Development of a Junior Participating Tactical Data System is continuing in order to provide a small size Naval Tactical Data System of standard configuration but of limited capabilities. This system will be backfit installed during overhaul in the smaller AAW and ASW escorts, and will permit the rapid exchange of tactical information with other tactical data systems over a common digital communications link.

The *Joint Advanced Tactical Command Control Program* provides the development work for the design and testing of data system interfaces. As automated tactical data systems are conceived, developed, and implemented to meet individual needs in each of the military services, it is realized that there are facets of tactical information in each system which can provide mutual benefit to other units. In order to achieve the collective advantages of automated systems in a joint service environment, the Joint Chiefs of Staff require that compatibility and inter-operability be demonstrated through actual tests and exercises of those systems which may be used in joint operations.

The Integrated Flagship Data System program is continuing with the assembly, functional system tests and installation this year of a prototype system in USS Providence (CLG-6). We expect to conduct at-sea tests and fleet evaluations on this prototype flagship data system during FY 1971.

We are continuing our efforts in the ASW Force Command and Control System leading to the development of an ASW force-oriented integrated system planned for the mid-1970s. We expect to complete the definition of the integrated system design concepts with the funds we have requested in FY 1971.

FY 1971 Research, Development, Test and Evaluation, Air Force

Excerpts from statement by Lt. Gen. Otto J. Glasser, USAF, Dep. Chief of Staff, Research and Development, Hq., USAF, before the House of Representatives Armed Services Committee.

This year, the Air Force Research and Development, Test and Evaluation program totals $2,909.7 million. Of this amount, $1,205.1 million is for major system development. The balance ($1,704.6 million) will support our other system developments, technology efforts, and the operations of our laboratories and management elements.

Strategic Offensive Capabilities

Our Research, Development, Test and Evaluation program for FY 1971 includes several efforts dedicated to the assurance of our future retaliatory capabilities. In the manned aircraft category, the effort expected to have its first impact on our operational forces is our FB–111 program.

The FB–111A is being developed as an effective strategic bomber to replace some of our older B–52s. . . .

Our planned procurement is now 76 aircraft. . . . We are requesting $16.3 million for the FB–111A this year.

The B–1, formerly the Advanced Manned Strategic Aircraft (AMSA), is needed as a replacement for the B–52 to maintain an effective bomber deterrent force in the late 1970s.

Requests for proposals for airframe and avionics were released to industry on Nov. 3, 1969, and engineering development contracts using FY 1970 funds are scheduled for award late this fiscal year. The propulsion system will be provided as government furnished equipment to the B–1 systems contractor. The $100 million in the FY 1971 budget request is needed for these contracts.

To enable the B–52/B–1 bomber force to penetrate improved enemy area defenses expected by the mid-to-late 1970s, we will need a decoy with vastly greater capability and credibility than our present Quail. Therefore, we are developing the Subsonic Cruise Armed Decoy (SCAD).

Due to the urgent requirement for an early initial operational capability (IOC) and concern for minimizing technical risks within austere funding constraints, two time-phased versions of SCAD are planned. SCAD A is being developed primarily as a decoy for the subsonic B–52, but designed with an option to be armed with a nuclear warhead. SCAD B will be a longer range decoy specifically designed for use with the B–1 and also having the option for nuclear armament. The armed SCAD may be used to attack area defenses such as airfields, radar sites, or control centers.

SCAD is now in concept formulation. In-house and contractor studies have been completed on the preliminary SCAD A design. Engine and decoy electronic studies are continuing, and our aim is to produce a flyable, feasibility model of a multi-band electronics payload and a SCAD A antenna mock-up.

We are requesting $33.6 million in FY 1971 to continue SCAD A development and efforts on decoy electronics and propulsion.

A totally different kind of weapon system is provided by the Short Range Attack Missile (SRAM). Its purpose is to enhance the capability of the B–52, FB–111 and B–1 to attack terminally defended targets. . . .

Past development problems, primarily with the motor, have delayed completion of the development by 26 months. Solutions for the technical problems have now been developed and flight testing has been resumed. The $46 million research, development, test and evaluation funds requested for FY 1971 are needed to complete the series, the final test being scheduled for the near future. We expect that the SRAM development contract will be completed in September 1971.

. . . Minuteman III is scheduled for initial deployment in the near future and will incrementally replace the Minuteman I missiles in the force. . . . Its improved third stage and post-boost propulsion system will provide the capability to carry multiple Mark 12 re-entry vehicles together with related penetration aids. . . .

We are requesting a total of $224.2 million for Minuteman squadrons in FY 1971. Of this amount, $38.8 million is needed to continue such effort as general support and to perform further in-place and in-flight hardness testing on the Minuteman II. Funds in the amount of $185.4 million are needed for systems integration and testing, guidance and control support, post-boost propulsion system testing, and in-place and in-flight hardness testing for the Minuteman III.

Our efforts to date have included evaluations of the following possibilities: hardening the Minuteman sites; providing a close-in hard point defense of the silos; reducing hard rock silo costs; and providing mobility for part of the force through wheeled or air cushion vehicles and deceptive shelters. For FY 1971 we are requesting $77 million to continue these studies. . . . In addition, we plan to complete presently scheduled calendar year 1970 hard rock silo engineering efforts to insure against unknowns and to provide an orderly basis for possibly proceeding with future new silos.

In FY 1969, we began a development effort (MICCS) designed to improve the command and control of the Minuteman force. Our efforts included preliminary design and development of a system to allow retargeting of the Minuteman force through generating target constants at the launch control facility.

In FY 1971, under the Command Data Buffer program, we plan to continue developments that will allow us to more rapidly retarget our missiles. We are requesting $10 million for this purpose.

Major emphasis within this program [Advanced ICBM Technology] is concentrated on advanced guidance and post-boost vehicle technology. The advanced guidance work is directed toward improving system survivability and increasing accuracy. We are conducting tests to verify nuclear hardening techniques for inertial guidance systems and tests of

continuous calibration and self-alignment techniques. Our post-boost vehicle effort includes analysis of nuclear hardening requirements and techniques and examination of solid propulsion systems. We will continue this work with FY 1971 funds.

As executive agent for the Defense Department, we also manage an advanced development program to provide improved re-entry systems and penetration aids for *all* U.S. strategic ballistic missile programs.

Some of the techniques being investigated include masking re-entry vehicles with chaff, decoys and electronic and optical countermeasures. Others include hardening of re-entry vehicles to survive in a defended environment, and new fuzing concepts to optimize weapon effects for a selected target. The program also provides technological support for current re-entry system engineering developments such as the Mark 12 system for Minuteman III and the Mark 3 for the Navy's Poseidon, and for operational re-entry systems such as the Mark 11 system for Minuteman II.

As the executive agent for this Defense Department program, we are requesting $105 million for FY 1971 to continue this development and to test advanced re-entry systems and technology for all the services. . . .

Strategic Defensive Capabilities

The primary function of strategic defensive systems is to strengthen deterrence. By presenting a clear capability to detect and disrupt the pattern of a nuclear strike, defensive systems increase the enemy's risk that even his best planned strike may not prevent our effective retaliation. Their secondary function, should deterrence break down, would be to limit damage to the United States.

AIR FORCE RDT&E BUDGET ESTIMATES

(In Millions of Dollars)

RDT&E PROGRAM BY BUDGET ACTIVITY	FY 1970	FY 1971
MILITARY SCIENCES		
In house laboratory independent research	$ 4.8	$ 5.0
Defense research sciences	80.7	78.8*
Environment	9.5	8.0
Materials	28.8	28.0*
Preliminary design/development planning	4.2	4.0
Innovations in education and training	-0-	3.5
Air force project RAND	12.6	11.0
Analytic services, Inc. (ANSER)	1.5	1.5
Studies and analyses Air Force	.8	.8
Total Military Sciences	$ 136.4	$ 134.6

*These funds include laboratory operating costs.

	FY 1970	FY 1971
AIRCRAFT AND RELATED EQUIPMENT		
FB-111 squadrons	$ 45.4	$ 16.8
SR-71 squadrons	0.8	—
A-7 squadrons	1.1	-0-
F-111 squadrons	126.8	48.2
RF-111 squadrons	2.0	—
Aerial targets	1.2	—
C-5A airlift squadrons	34.2	11.6
Aerospace flight dynamics	32.1	31.0
Aerospace biotechnology	17.1	19.0
Aerospace propulsion	26.5	27.0
Aerospace avionics	46.0	44.0
Aircraft propulsion subsystem integration	8.0	8.0
Advanced aircraft navigation	5.6	4.4
Light intratheater transport	-0-	2.0
Flight vehicle subsystems	5.7	10.0
Advanced fire control/missile technology	8.0	2.8
Advanced reconnaissance and target acquisition capability	4.7	—
Aerospace structural materials	8.2	9.6
V/TOL engine development	8.0	5.0
Advanced avionics	6.8	8.6
Advanced turbine engine gas generator	7.5	—
Subsonic cruise armed decoy	9.1	33.6
National clear air turbulence program	1.0	.8
CONUS air defense interceptor	2.5	2.5
Quiet aircraft	8.0	-0-
Advanced aerial target technology	-0-	—
F-4 avionics	4.0	—
V/TOL aircraft (US/FRG)	2.0	—
	175.1	870.0
...ery system	4.1	-0-
	2.0	27.9
	14.5	11.9
	.5	.5
	100.2	100.0
...ment	$ 708.2	$ 831.3

MISSILES AND RELATED EQUIPMENT
Short range attack missile
Minuteman squadrons
Minuteman integrated command and co...
Minuteman rebasing
Command data buffer
NIKE targets
Rocket propulsion
Advanced air-to-surface missile guidance
Air launched missile propulsion
Advanced ICBM technology
Advanced ballistic re-entry system
Strategic bomber penetration
Tactical air-to-ground missile (Maverick...
Air-to-air missile improvements
Hard rock silo development
Short range air-to-air missile (AIM-82)
Western test range
Eastern test range

Total Missiles and Related Eq...

MILITARY ASTRONAUTICS AND RELATE...
Defense support program
General purpose applications
Defense satellite communication system
Special activities
Satellite control facility
Titan III space booster
Manned orbiting laboratory
Space studies
Space applications planning
Advanced space power supply technolog...
Space experiments support
Satellites, balloons and rockets
Advanced space guidance
Advanced liquid rocket technology
Defense subsystem development and de...
Tactical satellite communication
Spacecraft technology and advanced re-...
Satellite system for precise navigation
Advanced satellite secondary propulsion
Space data relay subsystem
Advanced sensor technology
Midcourse surveillance system
Missile and space defense
Satellite data relay system
Aerospace

Total Military Astronautics an...

ORDNANCE, COMBAT VEHICLES AND R...
EQUIPMENT
Advanced weapons and applications
Conventional munitions
Close air support weapons
High energy laser program
Conventional weapons
Chemical-biological defense equipment
Armament/ordnance development
Improved aircraft gun system
Truck interdiction

Total Ordnance, Combat Vehi...
Equipment

These functions apply to both our missile defense systems and our bomber defense systems.

The nation's most serious defensive deficiency is our vulnerability to missile attack. Accordingly, we are investigating several concepts and related technologies for defense against future missile and space threats.

We are requesting $5 million in FY 1971 to continue our studies of an Advanced Missile and Space Defense system and supporting technology.

The Air Force has long believed that security from enemy missile attack requires a defense in depth that would enable early detection, tracking and discrimination of ICBMs, SLBMs and FOBs from boost throughout the midcourse and re-entry phases. . . .

We have initiated an advanced development program to apply new technology to the midcourse tracking and discrimination problem. A system employing satellite-based sensors looks promising, but we are investigating several alternate sensor/platform combinations to assure that no promising concept is overlooked.

. . . We are requesting $2 million to continue the conceptual studies and preliminary design work for this system.

The Advanced Sensor Technology program was initiated in FY 1970 to investigate the potential of various sensors for future surveillance and defensive systems. These sensors could be used in such system development as the Midcourse Surveillance System and Missile and Space Defense. The program will also develop optical instrumentation capable of evaluating the performance of penetration aids for offensive systems. To proceed, it is necessary that we first determine by an extensive measure-

	$ 84.7	$ 46.0
	868.0	224.2
ystem	20.0	-0-
	-0-	77.0
	-0-	10.0
	7.0	8.0
	24.7	25.0
ology	4.2	5.7
	.6	1.5
	15.0	—
	107.0	105.0
	2.1	—
	40.6	—
	2.7	-0-
	25.0	-0-
	14.0	87.2
	68.5	67.5
	143.3	118.0
t	$ 907.3	$ 762.8
UIPMENT		
	$ 78.7	$ —
	9.5	—
	20.8	6.7
	280.8	—
	36.2	87.0
	51.9	85.4
	125.0	-0-
	1.1	-0-
	-0-	2.0
	1.7	3.0
	16.8	16.0
	1.0	2.5
	5.7	6.0
	11.0	5.0
ation	18.1	-0-
	1.3	.7
ests	2.2	3.2
	2.0	1.5
n	.5	1.0
	2.4	—
	2.5	7.6
	-0-	2.0
	2.0	5.0
	.6	—
	22.2	19.5
ed Equipment	$ 642.4	$ 437.7
ED		
	$ 8.9	$ 8.0
	9.0	—
	2.0	2.0
	7.0	—
	15.1	—
	-0-	1.0
	18.4	11.0
	3.7	20.9
	10.0	10.0
Related	$ 69.1	$ 78.3

OTHER EQUIPMENT		
Strategic Air Command communications and control networks (SACCON)	$ .8	$ -0-
Post attack command and control system (PACCS)	.1	.7
UHF-emergency rocket command system (ERCS)	.8	2.8
Special purpose communications	1.7	-0-
Airborne warning and control system	40.0	87.0
CONUS over-the-horizon radar	2.8	5.3
Over-the-horizon radar system	2.8	3.0
Tactical air control system	2.5	4.5
Defense Communications Planning Group	14.0	—
Cryptologic activities	5.0	—
100th Strategic Reconnaissance Wing	12.2	—
Technical sensor collection	5.9	—
Intelligence data handling system	1.5	1.0
Air force communications	1.2	3.5
Traffic control, approach and landing system (TRACALS)	11.7	5.5
Air cargo materials handling	1.0	-0-
Ground electronics	36.5	35.5
Human resources	4.8	4.7
Over-the-horizon radar technology	2.0	1.5
Advanced devices	5.5	4.7
Advanced tactical command and control	3.7	4.0
Satellite communications terminals—tactical	1.8	2.0
Airborne satellite communications terminals—strategic	2.0	3.0
Loran D	1.8	3.6
Base security	1.6	1.6
Reconnaissance/intelligence exploitation	2.5	2.5
Penetration aids for manned aircraft	11.0	—
Simulator for air-to-air combat	1.0	-0-
Civil engineering technology	1.0	2.0
Design criteria for technical facilities	-0-	.5
Aeronautical Chart and Information Center	2.0	2.5
Integrated communications-navigation-identification	.5	2.0
Helicopter-borne radar	.6	.5
Advanced detection system development	8.6	—
Project Mallard	.9	1.7
Tactical information processing and interpretation	2.7	3.4
Air traffic control radar beacon system/air identification Mark XII system	.5	—
Joint advanced tactical command, control and communications program	2.0	1.0
Tactical jamming system	.4	—
Electronic warfare systems	10.8	—
Life support system	5.4	6.0
Other operational equipment	9.0	9.9
Lightweight precision bombing system	2.0	8.0
Intelligence/reconnaissance equipment	9.0	9.0
Systems survivability	1.8	—
Improved aircraft firefighting equipment	.5	.5
Sensors for weather reconnaissance activity	-0-	1.0
Cobra Mist	18.6	—
Arnold Engineering Development Center testing technology	7.6	7.6
Mapping, charting, geodesy	-0-	2.0
Common mobile supply equipment	-0-	4.0
Tactical electronic operational support system	-0-	—
Advanced airborne command post	1.0	2.0
Test instrumentation	5.9	-0-
Information Analysis Center	2.2	1.9
Electromagnetic Compatibility Analysis Center	5.4	5.5
Lincoln Laboratory	20.5	19.5
Mitre	11.2	9.0
Aircraft navigation system verification	.6	1.0
Total Other Equipment	**$ 302.8**	**$ 359.6**
PROGRAM-WIDE MANAGEMENT AND SUPPORT		
Development and test support	$ 139.7	$ 133.8
Acquisition and command support	173.9	170.9
International cooperative R&D	.2	.2
International military headquarters and agencies	.5	.5
Total Program-wide Management and Support	**314.3**	**305.4**
Total Air Force FY 1971 Research, Development, Test and Evaluation Budget	**$3,080.5**	**$2,909.7**

ment program the actual target signatures from re-entry vehicles and associated penetration aids, as well as the backgrounds which provide interference.

The $7.6 million in our FY 1971 program request will be used to begin measurement with sensors aboard satellites launched by our Space Experiments Support Program (SESP). Development will also begin on the instrumentation for suborbital flights aboard Atlas boosters to evaluate penetration aids developed under our Advanced Ballistic Re-entry Systems (ABRES) program.

We are requesting $87 million in the FY 1971 program to initiate systems engineering of an austere version of airborne warning and control system (AWACS). Prior to committing large sums of money for production, we plan to demonstrate with a prototype system that the AWACS mission can be successfully accomplished. . . .

. . . Our current program [for defense of the Continental United States] is to deploy over-the-horizon backscatter (OTHB) radars so they will have the capability to detect approaching bombers anywhere within their surveillance arcs out to significant ranges.

Our FY 1971 program request includes $5.3 million to complete contract definition and to begin development leading to an initial operational capability in 1975.

An improved manned interceptor with the capability to detect and destroy low altitude enemy bombers is essential to improving our nation's air defenses. Since the fire control and missile system is the longest lead time item in developing an improved interceptor, we are using funds available in FY 1970 to initiate the design and system engineering of an improved fire control/missile system. We will take advantage of technology and expertise derived from our earlier F-12 fire control and missile system work, the Navy's Phoenix System, and the radar systems now being developed for the F-15.

We are requesting $2.5 million in 1971 to continue system engineering of the improved fire control/missile system mentioned earlier so that we may design and fit the system to the selected airframe. If the airframe is approved in the near future and sufficient funds are provided, an improved interceptor could achieve an initial operational capability by the mid-1970s.

Tactical Air Capabilities

Operationally, . . . tactical air forces perform one or more of their classical missions: counter-air, including combat zone air defense; close air support; interdiction; tactical air reconnaissance; and tactical airlift.

With a variety of sensors for surveillance, its data processing and display equipment, its extended communications capability, and with delegated decision authority on-board, the AWACS is uniquely capable of serving as a tactical force control center. AWACS will provide positive control of strike aircraft, reduce aircraft losses, increase kills of enemy aircraft, and reduce missions aborted through premature release of weapons due to the threat of enemy air attack.

Although we are pleased with the technical excellence of the Mark II avionics system on the F-111D, cost increase have led us to limit its installation. Accordingly, we have developed a more austere avionics system consisting of components of the Mark IIB (FB-111 system) and of the Mark IIA (F-111 A/E system) for use in the later production fighters the F-111Fs. This system will be comparable in performance to the Mark II (F-111D) except in its capability for acquiring moving targets.

Flight testing by the contractor and the Air Force will continue this year and through FY 1971. The first F-111F with the new P-100 engine and the new austere avionics package is scheduled for its initial flight in the near future. This will lead to a squadron IOC shortly thereafter. We are requesting $48.2 million for the F-111 research, development, test and evaluation program, of which $18.8 million is to complete development of the P-100 engine.

During the past four years, we have made excellent progress in the development of suitable engines and radars for the F-15. Prototype engines have been running on test stands as a result of our joint Advanced Technology Engine project with the Navy. . . . Prototype radars will be flight tested, with engineering contract selection scheduled for October following the flyoff competition.

During FY 1971, we plan to continue with detailed design efforts and with wind tunnel, material structural and subsystem development testing. We also plan the release of long lead time items to subcontractors. We are asking for $370 million for these purposes.

Every modern war has reconfirmed the value of aircraft as mobile platforms for timely delivery of accurate firepower in close air support of engaged ground troops. The A-X is specifically designed for this mission. . . .

Studies directed by Office of the Secretary of Defense last year have been submitted along with our proposal to initiate engineering development late in FY 1970. We plan a competitive prototype development, in which two contractors will each build two aircraft. A competitive fly-off test program will determine which contractor will be awarded the contract for final A-X development and production. We are requesting $27.9 million to continue development of these prototype aircraft in FY 1971.

The SA-2 surface-to-air missile threat to our forces flying over North Vietnam motivated development efforts to counter this and other radar controlled defensive systems. The F-105 Wild Weasel detection and attack system was one of several methods employed in this countermeasures role. Therefore, we are developing a new system, tailored for the F-4D, and capable of vastly improved performance.

Earlier studies funded under the Aircraft Equipment Development line item defined the program, identified the necessary technical developments and performed some component development and testing. In FY 1971, we plan to continue development of prototype systems, complete the necessary qualification, reliability and integration testing, and install the system on an F-4D aircraft.

In our Aircraft Equipment Development program, we develop, test and evaluate a wide variety of subsystems and equipments, drawing heavily on

the results of our exploratory and advanced programs in avionics, propulsion, flight dynamics and materials. . . .

We are requesting $11.9 million in the FY 1971 program to continue work on such items as a radar correlation bombing system, sensors for target detection, advanced cockpit instrumentation and an advanced laser-/seeker designator. In addition to these developments, we are also investigating such items as palletized guns for converting transport aircraft to gunships.

To be reliable for combat situations, weaponry must be tested under operational conditions and on realistic targets. Accordingly, we have initiated a new program to develop advanced aerial targets and ancillary equipments for air-to-air and surface-to-air missile tests.

The primary project in our Advanced Aerial Target program is the High Altitude Supersonic Target (HAST). This new vehicle will provide all three services with a low cost target capable of operating at speeds varying from subsonic to over Mach 3 and at altitudes ranging up to 100,000 feet. Supporting tasks include development of advanced radar and infrared augmentation, which will more realistically simulate the radar cross sections and infrared signatures of threat aircraft. Unrealistic simulation has been a continuing problem in using small target drones. We have also had a problem in measuring how close our missiles come to the target drones in the event there is no direct hit. The Vector Miss Distance Scorer will solve this problem and aid us in evaluating the probability of kill of our missiles and in determining the correct warhead fuzing.

Maverick's first guided test flight last year was a success. It did lethal damage to a tank from a significant range. Further contractor testing of this nature is scheduled for completion in FY 1971.

During FY 1971, we also plan to begin Air Force Category II weapon system testing. . . .

The AIM-82A Short Range Air-to-Air Missile will be developed in parallel with the F-15 aircraft and optimized to operate along with it. However, the missile will also be made compatible with other fighter aircraft such as the F-14, F-4, A-6, A-7 and F-111. The F-15/AIM-82 interface analysis was completed in July 1969 and it is anticipated that contract definition will be initiated later this year. We are asking for $37.2 million in FY 1971 so that development of the AIM-82 missile may commence.

New guns and improved ammunition continue to be needed as essential parts of our aircraft armament systems. Our program includes development of a family of improved 20mm rounds for existing guns to achieve greater capability against lightly armored vehicles and personnel carriers. In addition, two completely new guns are in development: one for aerial combat and the other for close air support.

We are asking for a total of $20.9 million during FY 1971 for this program.

The immediate [Truck Interdiction] program goal is to provide our operational forces with improved munitions. . . . We plan to address longer-term solutions to the problem of vehicle destruction after we accomplish this immediate goal. We are requesting $10 million to continue our truck interdiction development efforts in FY 1971.

Our new [conventional] weapons are developed under three closely related research and development programs: conventional munitions, conventional weapons, and armament ordnance development. Conventional munitions is our exploratory development program in which we seek new weapons concepts and techniques, conduct studies to identify future weapon applications, and select the most promising items for continued development. Conventional weapons is the follow-on advanced development program, wherein promising weapons concepts are translated into prototype hardware for feasibility and effectiveness testing. Candidate concepts found acceptable by ground and flight tests are then forwarded for further development in the armament/ordnance development program. Here, engineering development of the most promising weapons is completed, designs are finalized and necessary testing performed.

We are requesting $27.5 million for all three programs in FY 1971. With these funds, we plan to continue our work in improved gun propellants, a hard structure munition, fuel-air explosive weapons, low cost optical fuzing and large cratering devices. We will also investigate a modular weapons concept, permitting interchanges among the warheads, guidance packages and other parts of the weapon and adaptation of our weapons to meet the demands of particular targets.

Airlift Capabilities

The tactical airlift force, consisting largely of aircraft over 10 years old, is aging at an accelerated rate due to wartime use rates. To modernize this force, we will need rugged and easily maintainable transport aircraft with sufficient performance characteristics and survivability for efficient operation from crude and very short airfields close to the battlefield. We will also need on-board, self-contained devices for rapid loading and unloading in unprepared areas.

The research, development, test and evaluation phase of the C-5A program nears completion. We anticipate that contractor and Air Force flight testing will be completed early in FY 1971 and that Category III operational suitability testing will begin sometime during calendar year 1970. . . .

We are asking for $11.6 million in order to complete this research and development program.

Our tactical airlift mission is presently being accomplished by C-130, C-123, and C-7 aircraft. . . . Our studies indicate that a new aircraft, the Light Intratheater Transport (LIT), is one of the stronger candidates to replace these older systems.

Either a V/STOL or STOL system provides a viable alternative to achieve tactical airlift modernization. We are deferring the decision as to which alternative will be selected. In FY 1971, we plan to continue and expand our work on promising V/STOL and STOL technologies, to initiate flight control investigations, and to continue our study of alternatives for the tactical airlift mission. Our program request contains $2 million to contribute to these purposes.

For some time we have recognized the inherent advantages of aircraft

FY 1971 RDT&E Air Force Program

($ Millions)

Major System Development

	FY 69	FY 70	FY 71
Strategic Aircraft			
FB-111 Squadrons	62.7	45.4	16.3
B-1	25.0	100.2	100.0
Subsonic Cruise Armed Decoy (SCAD)	1.7	9.1	33.6
CONUS Air Defense Interceptor	-0-	2.5	2.5
Missiles			
SRAM	135.3	84.7	46.0
Minuteman Squadrons	414.4	353.0	224.2
Minuteman Rebasing	-0-	-0-	77.0
Hard Rock Silo	23.0	25.0	-0-
Astronautics			
Defense Support Program	95.6	73.7	
Other			
AWACS	39.3	40.0	87.0
CONUS OTH Radar	-0-	2.8	5.3
OTH Radar System	1.8	2.8	3.0
Total Strategic	798.8	739.2	*
Tactical Aircraft			
A-7 Aircraft	7.4	1.1	-0-
F-111 Squadrons	99.6	126.3	48.2
RF-111 Squadrons	6.0	2.0	
F-15	68.5	175.1	370.0
A-X	-0-	2.0	27.9
Missiles			
Maverick	43.6	40.6	
Short Range Air-to-Air Msl (AIM-82)	2.1	14.0	37.2
Total Tactical	227.2	361.1	*
Other Mission Aircraft			
C-5A	126.0	34.2	11.6
Light Intratheater Transport	1.0	-0-	2.0
Total Other	127.0	34.2	13.6

* Total figure for this program not given because certain classified line items have been excluded.

with a vertical lift capability. Therefore, to increase the knowledge needed for development of an effective VTOL capability, we are pursuing technology efforts in three main areas: direct lift engines, propellers, and exploitation of foreign equipment.

The direct lift engine effort is being conducted jointly with the United Kingdom, and is currently in the en- est phase. We are close to ng our technology goal, and by mutual agreement with the U.K., we will complete the direct lift engine effort during FY 1971.

Some VTOL utilizations, such as the Light Intratheater Transport and Advanced Rescue and Recovery System, will require a minimum amount of propulsion downwash. Therefore, we are investigating the technology of large diameter propellers—particularly the blade design, the gear box design and the use of new materials. Eventually, we plan to test a large scale propeller with cyclic pitch control. We are requesting $5 million to continue our propeller and exploitation efforts in FY 1971.

Technology Base

. . . To provide the base for the next generation of systems, I would like now to discuss some of the technologies that we believe will be needed "tomorrow."

Most of our technology results from our exploratory and advanced development programs. It is these development categories that provide the know-how and the techniques which prepare us to meet the needs of the next decade. . . .

The technology efforts closest to application in systems engineering are found in our advanced development programs. Several of the programs I have already discussed are in this category. While many of our other advanced development programs are equally applicable to specific system development, most are useful in more than one system. I will discuss a few of these to illustrate their role in the time-phased, building-block approach to weapon systems development.

The Advanced Turbine Engine Gas Generator (ATEGG) and Aircraft Propulsion Subsystem Integration (APSI) programs have fed directly into several system development efforts. In the ATEGG program, we design, fabricate and test gas generator cores using the latest component technology. These are not complete engines but long lead-time parts consisting of the compressor, combustor and turbine. We test only enough to prove that the core design can be used in a new propulsion system designed for a specific purpose. The B-1 demonstrator engine and the F-15 initial engine development are direct derivatives of this program.

Similarly, we have found that engines designed independently of airframes may have devastating results on overall weapon system performance. The Aircraft Propulsion Subsystem Integration (APSI) program is designed to provide the technical capability to integrate the engine with the airframe and obtain optimum performance from the total system. We are applying this technology to the F-15 development by providing

data on completed engine inlet tests to the F-15 contractors.

Another advanced development that has direct application to aircraft systems development is the Flight Vehicle Subsystem program. Since a major cause of aircraft losses to enemy ground fire has been damage to the flight control systems, we are developing a Survivable Flight Control System. This system is an all-electric, quadrupally redundant system potentially usable in the B-1 program.

Our Advanced Avionics program seeks to improve our ability to hit small targets under all conditions of visibility. The primary effort is devoted to development of sensors with their cockpit displays and to integration of these devices with other aircraft subsystems into a complete fire control weapon delivery system. The high payoff of this advanced development effort is illustrated by the forward looking infrared sensor and low light level TV now in use on aircraft in Southeast Asia. Current effort includes an electronically scanned, phased array radar antenna for strike aircraft and completion of an all-weather close support weapon delivery system.

One final advanced development I would like to mention is the Advanced Space Guidance program. The objective of this program is to develop and demonstrate an instrument which can indicate the precise pointing direction of various spaceborne sensors and communications antennas. Applications for this device include reducing ICBM target location uncertainties, improving space object surveillance and tracking, aiding precise navigation techniques, and improving satellite inspection.

We turn now to exploratory development. . . . In flight dynamics we are doing work in the five technical areas that will provide the technology for future aerospace vehicles: aircraft structures, flight controls, flight mechanics, dynamics and equipment. Representative of our work in this field are our efforts to reduce the weight and vulnerability of aircraft structures and to improve flight control and aerodynamic performance at transonic speeds. The components and technical data produced by this exploratory effort are used to produce subsystems and design data for advanced aircraft systems, including the F-15 and B-1.

Our Aerospace Propulsion program provides for technological advances in five functional areas: turbine propulsion, ramjet propulsion, electric power, electric propulsion, and fuels and lubricants. The individual components produced by this program are integrated into advanced propulsion systems and then into airframes for testing under two advanced development programs I mentioned earlier: Advance Turbine Engine Gas Generator and Aircraft Propulsion Subsystems Integration.

Avionics is one of our most important exploratory development programs. It advances technology in the areas of navigation and guidance, weapon delivery and fire control, aerospace surveillance, communications and electronic countermeasures. . . .

The Rocket Propulsion program provides the technology needed in both solid and liquid propellant rocket engines for new ballistic missiles, tactical missiles and space propulsion systems. We are concentrating our efforts on the design and operation of such items as thrust vector control, high energy propellants, and advanced cooled combustion chamber and nozzle concepts. . . .

Our work in the Advanced Weapons and Applications Technology program is closely coordinated with organizations such as the Atomic Energy Commission (AEC) and the Defense Atomic Support Agency (DASA) to develop concepts and equipment for the employment of advanced weapons. Our recent efforts on nuclear warhead design criteria for the Subsonic Cruise Armed Decoy (SCAD) and radar and infrared optical fuzing for hypersonic re-entry vehicles are representative of our many activities in this program.

The Ground Electronics program advances technology over a wide range of activities for application in the areas of surveillance, intelligence collection, data processing and display, and command, control and communications. . . .

One other exploratory development program, which is newly identified in our research, development, test and evaluation request this year, is Space Applications Planning. The analytical efforts in this program define advanced system concepts and evaluate the economical and technical feasibility of these various concepts. To date, we have conducted efforts in such high interest areas as space navigation, midcourse surveillance, satellite inspection, multipurpose reusable spacecraft, and the economies of recoverable spacecraft. We have also performed analyses on space escape systems, space antennae and other special defense projects. We are requesting $2 million to continue investigation into these and other important efforts.

HardiMan Helps Lift Heavy Loads

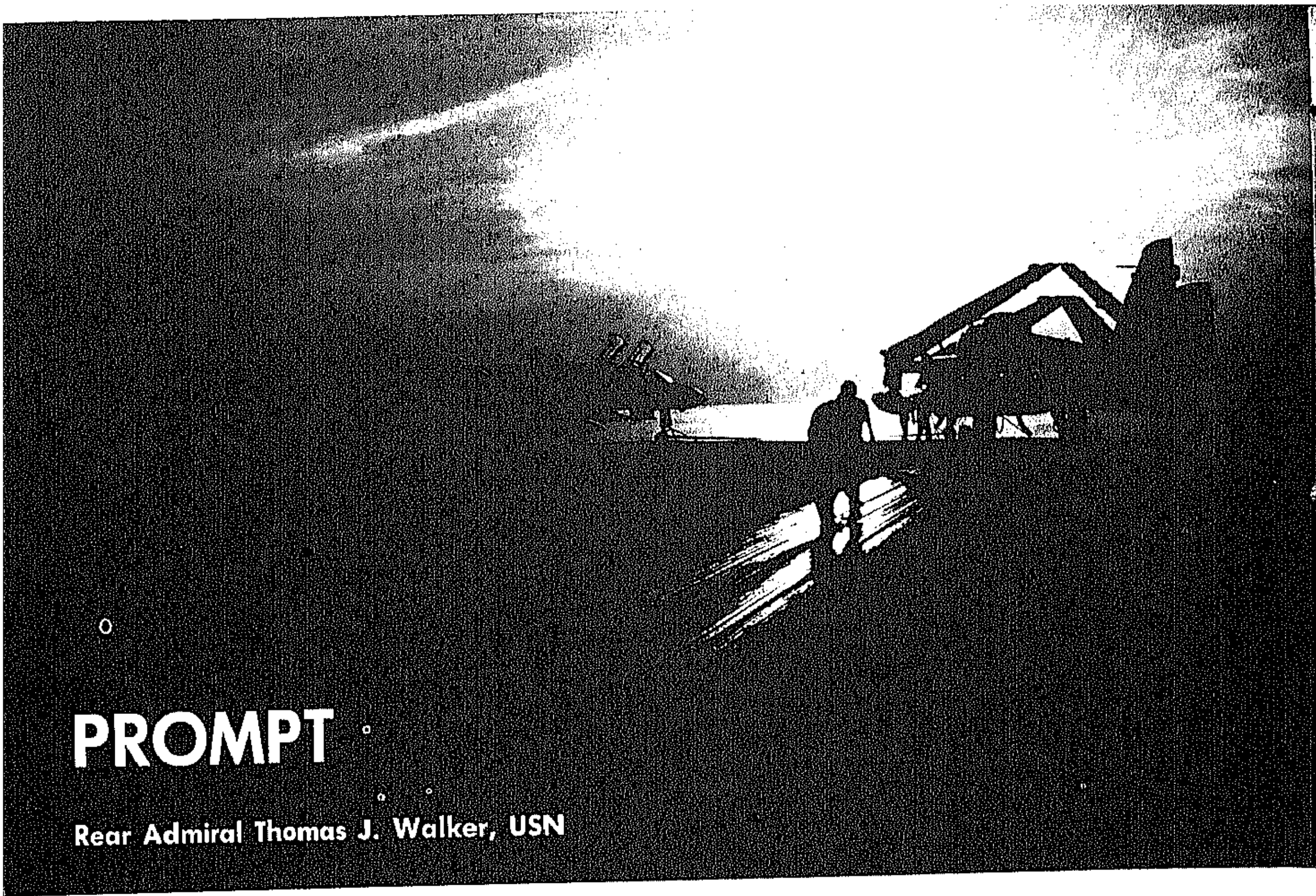
Mechanically muscled men are the objectives of a joint Army and Navy program called HardiMan (Human Augmentation and Research and Development Investigation). HardiMan is a metal exo-skelaton of general human configuration.

Under a contract with the Army Materiel Command and the Office of Naval Research, the Research and Development Center of the General Electric Co., Schenectady, N. Y., has produced a prototype left hand.

Test engineers at the Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., were able to lift loads up to 750 pounds by mating their own left arm with the mechanical counterpart, which is also attached to a fixed stand at shoulder level. The entire unit should enable men to lift, lower and walk with 1,500-pound weights.

With its own power source, HardiMan will amplify every movement of its operator through hydromechanical circuitry linked through sensors. The operator will be mated to the structure at the arms, feet and girdle or cross piece. A system of levers, control linkages and servomechanisms will permit walking, bending, turning, or other movements with a minimum of restraint on the man.

Delivery of a complete prototype is expected in early 1971.



PROMPT

Rear Admiral Thomas J. Walker, USN

Design and fabrication of the many sophisticated weapon systems in the Navy's highly mobile carrier strike force has become increasingly more complex. Within the Navy, responsibility for aircraft and airborne weapons, as well as related shipboard and ground support equipment, necessitates central direction of the research, development, test, evaluation, acquisition, and logistic support phases associated with each project resulting from a Specific Operational Requirement (SOR).

The prime responsibility for developing the concept and subsequent acquisition of the ultimate in Naval air power rests with the Commander of the Naval Air Systems Command (COMNAVAIR), one of the six systems commands of the Naval Material Command. Responsibility for planning, directing, and controlling the definition, development, and production to meet an SOR is delegated, in turn, to NAVAIR project managers.

To achieve successful project management, there is always a need for management systems that are broad in scope, flexible in application, and that provide uniform data related to both contractor effort and government facilities, including government furnished equipment. Only through teamwork between the contractor and concerned government offices can successful project management be achieved. Summary data must be presented through these systems in a manner that is both meaningful and relevant. Data regarding trends in improvement or lack of progress in a system must be accurate and timely. Data systems must be standardized and integrated into a cohesive unit which will provide a flexible, comprehensive management tool for total project management.

Contractors and concerned government offices have recognized the need for complementary management systems. Approved systems are being formulated. The framework for effective management within the Defense Department has been established in the resource management effort which is subdivided into two major areas: Project PRIME consisting of programming, budgeting and operations management systems and Assets Management composed of inventory management systems and acquisition data and management systems.

NAVAIR's answer to the need for a management system is PROMPT (Project Reporting, Organization, and Management Planning Techniques). PROMPT encompasses total project management and is NAVAIR's means for executing the DOD Acquisition Data and Management System (Figure 1). This system, presently adopted on the S-3A and the F-14A aircraft projects, provides a means of monitoring the accomplishment of the acquisition plan with emphasis on supplying up-to-date data relating to project trends. Eventual use of PROMPT by all NAVAIR project offices will ultimately provide the command a uniform management system and an aid to smooth progress in the development of new weapon systems.

Besides fulfilling the need for total project management, other attributes of PROMPT are:

- Uniformity of management data.
- Flexibility to the extent that it can be tailored to specific needs of the project manager.
- A total system, documented and identified for contract purposes.
- Controls for both government and contractor effort.
- Timely and accurate management data for decision making by the project team.
- Parallelism in the phases of development of a weapon system.
- Achievement of requirements of the DOD and NAVAIR integrated management system.

Additionally, PROMPT is a part of the Council of Defense and Space Industry Associations' inventory of management systems.

Comprehensive Management Tool

As a tool for total project management, the PROMPT Management System is composed of five essential elements: acquisition plan, work breakdown structure, management techniques, management reports, and control manuals. Although certain guidelines must be followed in the use of these five basic and essential elements, each is flexible and can be constructed to meet specific project management needs. A brief explanation of each of these elements will give the reader an insight into the composition of PROMPT.

The **Acquisition Plan,** established by the Chief of Naval Material as the master planning document for the development, management, and procurement of weapon systems within the Naval Material Command, combines the Technical Development Plan and Project Master Plan to produce a principal project document. This document then serves as a basic source of input to all supporting plans, such as the advanced procurement plan, training plan, quality assurance plan, configuration management plan, systems effectiveness, etc.

The Acquisition Plan serves the dual purpose of defining and justifying the project for the Office of the Secretary of Defense, the Chief of Naval Operations, and the Chief of Naval Material. Concurrently, it provides guidance and support to project managers. It establishes a technical requirement summary; identifies the responsibilities of those involved in the project; provides the framework for life-cycle procurement, production, and integrated logistic support for the project. The Acquisition Plan establishes the requirements and formulates and formalizes the plans for project development.

The **Work Breakdown Structure** (WBS), evolving through several steps, serves as the foundation for execution and control of the project. WBS graphically displays as a family tree organization chart, the manner in which responsibilities are divided, resources are applied, schedules are determined, and work is planned and accomplished for the prime mission system and for the integrated logistics support of the prime mission system. WBS associated with PROMPT establishes a uniform and common communication system by providing a logical structure for collecting management data, preparation of reports, and analyzing progress. It provides a foundation for management data flow between the Government and contractor, whether it is concerned with cost, schedule, or technical performance.

On the basis of the SOR developed for the project, the total project effort is then divided into separate divisions of prime mission system and integrated logistic support. Each of

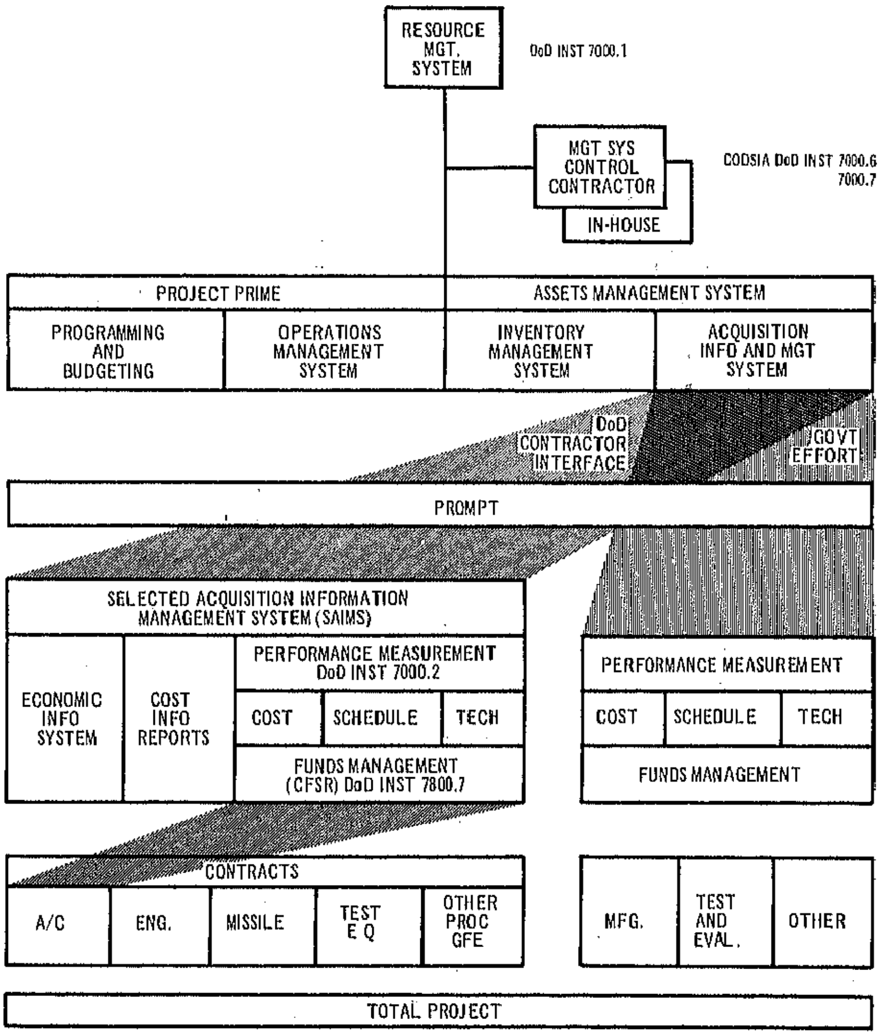


Figure 1.

Master Work Breakdown Structure

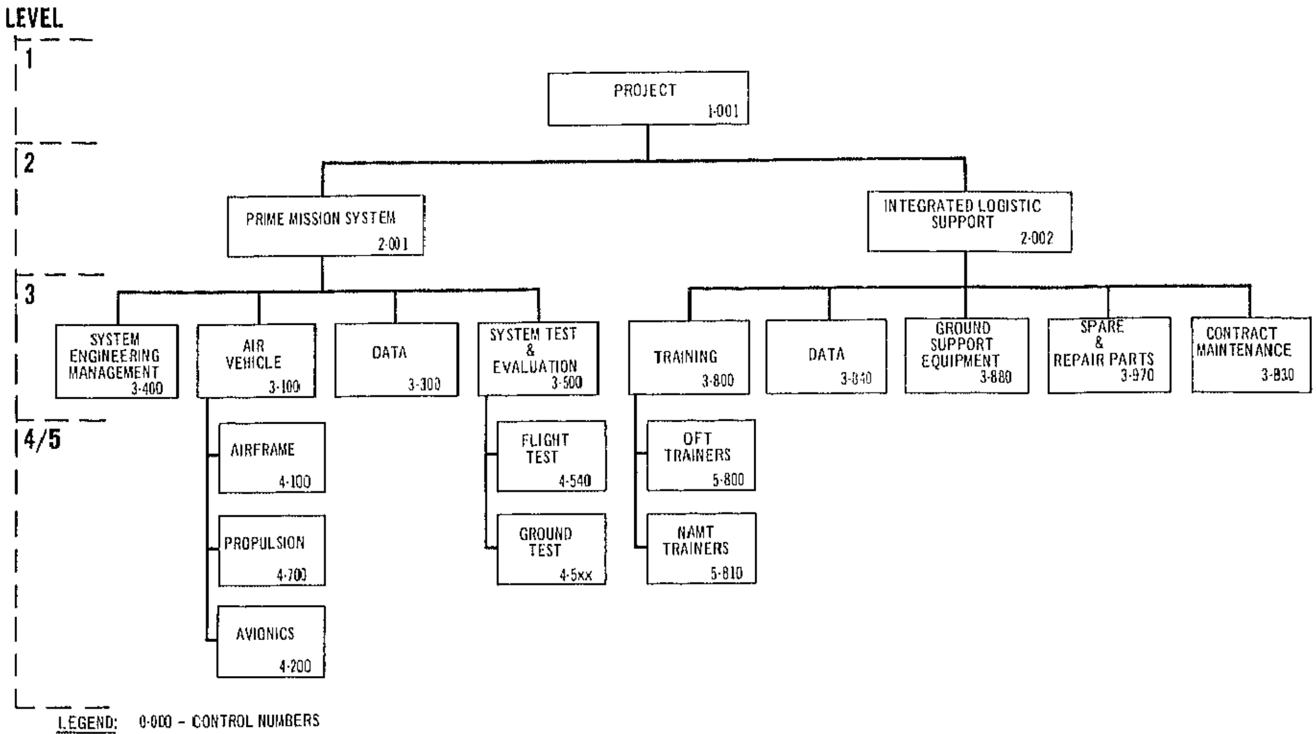


Figure 2.

these divisions is further broken down and classified into specific areas of work responsibility (Figure 2). Definitions for elements at these levels are made to conform to military standards.

Control numbers are assigned to each element of the work breakdown structure for the purposes of common communication (reference points) between the Government and contractor. When a contract is signed, a final complete project WBS is established for the total task to be accomplished, broken down into component tasks and work packages, subtasks, with elements of the prime mission system and integrated logistic system defined.

Any one element of a WBS will be looked at differently by various members of the project management team. To the engineer, an element such as an *airframe* must be technically correct and pass all tests. To the budget analyst, this same element is viewed in terms of *actual versus planned costs*. To the project manager, the airframe involves problems of *production* and *scheduling*, within *cost* and *technical* boundaries. In all cases, however, WBS identifies the particular area of work being considered and provides the common baseline necessary for proper data flow.

To coordinate the various project activities being conducted by the Navy, contractors, and government-furnished-equipment facilities, it is necessary to establish during the contract definition stage detailed work breakdown structures and schedules for each segment of the weapon system. Also, it is necessary to coordinate these schedules. The PROMPT Work Breakdown Structure Interface Network provides a visual portrayal of the sequence of development of each item on the contract, and links these paths together at appropriate action points. PROMPT provides the same basic project summary WBS to both the contractor and government facilities, from which each can develop extended WBSs in parallel. The end result of the WBS development process is orderly planning and the ability to relate time, cost, and technical performance reports to a common base.

PROMPT Management Techniques include:

- WBS Interface Network where detailed WBSs and schedules are established for each segment of the weapon system.
- Alignment of contract line items on the contract to the contractor WBS.
- Alignment of the NAVAIR tasks, assigned to the government facilities, to the contract/project summary WBS.

These techniques promote integration of the other elements of PROMPT into a total project management effort. The uses of management techniques vary within different phases of the procurement program.

Management Reports. The PROMPT Reporting System is based upon the premise that management does not require total information, but only summary data necessary for decision-

making purposes. The data to be reported results from the contractor's levels of the WBS, and may be in the internal performance measurement system. It flows from the functional departments of the contractor up through the structure of the WBS. Summary reporting occurs at the project and prime mission system levels of the WBS, and may be in the form of summary milestone charts, trend charts, etc. Control numbers, assigned to each element of the WBS, are used in communication to facilitate identification of subject matter under discussion.

Summary reports are forwarded simultaneously to the contractor's action center and to the Government. These summary reports are used to update control manuals in the possession of the project manager and his team. Thus, both the contractor and the Government are using the same reports and a common management system. PROMPT reports contain data regarding time, cost, and technical performance and can be designed to meet each project's specific needs. They consist of Hot Line Reports, Weekly Action Reports, Milestone Charts, Trend Charts, Variance Reports, and a series of Financial Reports. Briefly described, these reports are:

• Hot Line Reports are transmitted between contractor and government project managers. They are used to inform project managers of problems that require priority action in the areas of time, cost, and technical performance, and may be written as confirmations of telephone calls. The reports are serialized and, thus, provide a controlled communication system.

• Weekly Action Reports are intended for use by the project manager. They contain data on items of a routine nature, as well as those requiring immediate attention and action. They serve as a direct line of communication between the contractor and project manager.

• Milestone Charts perform a dual purpose. They present the schedules for project development and the responsible organizational segments, and also serve as a means for reporting progress made against these schedules. The charts are keyed to a WBS control number, thus specifying the exact areas of work under discussion in terms that are familiar to both the contractor and the Navy project management team. They provide the means for comparing costs to schedules for the given WBS number on a single form. These selected summaries are provided only for high level WBS status reporting, and are updated and submitted quarterly.

• Trend Charts reflect, at a glance, progress in meeting milestone target dates or some other measurable performance. The number of weeks ahead or behind schedule is indicated, and positive or negative trends are immediately visible. Trend Charts are used for technical, schedule, and financial data.

• Variance Reports are narrative in form and serve either as follow-ups to Trend Charts or as indicators of other problem areas that have developed. They define adverse trends that have been indicated on the Trend Chart, identify the impact of these trends, provide recovery plans, and indicate the required action that is necessary. Variance Reports are submitted on an "as-required" basis.

• Financial data is vital to project managers. They need to have data available concerning such areas as planned and actual expenses, financial trends, specific contract line items expenditures, and the status of the total appropriation. PROMPT Financial Reports reflect summary data taken from the internal performance measurement system used by the contractor and approved by the Government. They offer a comprehensive picture of the budget and appear in a variety of formats, allowing the financial status of the project to be studied in varying terms. PROMPT allows the project manager flexibility in his approach and meets his requirements through several types of financial reports:

Expenditures and Commitments Reports—monthly contractor-prepared reports in the form of trend charts. They graphically display planned versus actual amounts of money expended and committed, by appropriation. Use of these reports enables the project manager to forecast future trends in comparison with the original projected plan of expenditures and commitments.

The Cost Summary Status Report—a monthly contractor-prepared report. It is oriented to the work breakdown structure by item number and provides data regarding the latest total budget, estimated budget at completion, and current variances. Expenses are also broken down in terms of labor hours, labor dollars, overhead, government dollars, and planned value of work scheduled and accomplished. This report is useful to the project manager in predicting trends, especially because figures specifying estimated overruns and underruns are included in this report.

Contract Funds Status Report—a quarterly contractor-prepared report submitted to the project manager in the Project Profile Manual. It displays funding information to contract line items in terms of the total project being purchased from the contractor by fiscal year. This report also forecasts future funding requirements.

Cost Summary Trend Chart—a graphic portrayal of the financial status of the prime mission system project cost summary. Trends are re-

Rear Admiral Thomas J. Walker, USN, has been Commander, Naval Air Systems Command, Washington, D. C., since February 1969. Before he assumed command, he served in NAVAIR as Deputy Commander for Plans and Programs, and Comptroller. Admiral Walker is a graduate of the U. S. Naval Academy, Annapolis, Md., and is a naval aviator. He also attended the Postgraduate School, Annapolis, where he completed the course in ordnance engineering (aviation).

Funding Control

(Dollar figures to nearest million)

WBS No.		Airframe Contractor	Engine Contractor	Missile Contractor	Other GFE	Government Effort	Funds by FY	
1000	Prime Mission System	$200M sum	30	30	30	10	$300 sum	FY Funds by Oblig Plan
1100	Sys Engr & Project Mgt	3	2	3	—	2	10	
1200	Air Vehicle	142	18	15	28	—	203	
1300	Data	5	1	1	—	2	9	
1400	System Test & Evaluation	50	9	11	2	6	78	

Figure 3.

flected in the areas of planned value of work scheduled, planned value of work accomplished, actual cost, projection of the planned value of work accomplished, and a projection of the total cost.

Funding Control Matrix Chart—a demonstration of the manner in which project funding is developed and controlled by the project manager. The chart uses the PROMPT work breakdown structure as a foundation for data flow. Cost estimates are recorded for each major procurement within a project by aligning costs to WBS items. Fiscal year funds required by contract or by total program can be determined from the applicable matrix. Data obtained from this procedure can be used to estimate requirements for the Five Year Defense Plan, justify the fiscal year budget, or develop obligation plans (Figure 3).

The fifth element of PROMPT, Control Manuals, complements the work breakdown structure by presenting a standard package of data adoptable to any major project. The Control Manuals present, in an organized manner, the measurable plans of all major activities participating in the project, and the reports developed to monitor the progress against the plans. Separate control manuals are established for monitoring progress in specific areas of development, such as contractor effort, government effort, and integrated logistic support.

Each manual will have several objectives. One document will reveal all the essential facts of a specific area of project development. The reports will be oriented to the project management decision-making process. Data provided will be current, enabling the project manager to predict future trends. Each manual is constructed in loose-leaf form for easy updating.

Probably the most important single attribute of PROMPT is that it is a total project management system, structured around the five essential elements described in this article. In the next few years, the PROMPT Management System will be scrutinized closely as it is applied to the beginnings of two vital aircraft programs: the new supersonic F-14 fighter and the S-3 carrier-based antisubmarine warfare aircraft.

NAVAIR is confident that, with these two weapon system programs, PROMPT will be able to demonstrate clearly the benefits and effectiveness of this total project management system.

SAMSO Gets Western Test Range

An organizational change that will increase mission and geographic responsibilities of the Air Force Systems Command's Space and Missile Systems Organization (SAMSO), El Segundo, Calif., has been announced by the Air Force.

The change involves the Western Test Range, Vandenberg AFB, Calif., and SAMSO's two aerospace test wings, at Vandenberg and Patrick AFB, Fla. The three will become the Space and Missile Test Center (SAMTEC), under the command of SAMSO.

Previously, the Western Test Range, which stretches from California to the Indian Ocean where it meets the Eastern Test Range, was managed as an independent unit reporting to Air Force Systems Command headquarters in Washington, D.C. With the reorganization, SAMSO becomes responsible for operating the range where many of SAMSO's flight tests are conducted.

Major General Clifford J. Kronauer, who commanded the Western Test Range, will remain as commander of SAMTEC, with headquarters at Vandenberg. Responsibilities include range engineering and support activities, and direction of SAMTEC launch operations at both Vandenberg and Patrick AFB.

USAF-FAA Developing Radar Data System

A new radar processing device has been jointly developed by the Air Force Systems Command's Electronic Systems Division, L. G. Hanscom Field, Mass., and the Federal Aviation Administration (FAA). Known as a common digitizer, the new equipment will replace present radar signal processors used by DOD. The common digitizer will allow the Air Force and FAA to share radar information for FAA air traffic control and for military air defense.

The new system will relay radar information over telephone lines for both the Air Force and FAA.

Contractor for the common digitizer equipment is the Defense and Space Group, Burroughs Corp.

Analysis and Evaluation of Proposed Army Investments

Lieutenant Colonel John M. Brown, USA

Lieutenant Peyton L. Wynns, USA

Considerable attention has been given during recent years to the use of analytical techniques in the allocation of government resources, particularly to military hardware. Although the Bureau of Reclamation and Corps of Engineers began estimating costs and benefits in the 1930s, not until the late 1950s and early 1960s was economic analysis applied to government investments on a much broader basis.

As economic analysis program was formalized in the Defense Department with the publication of DOD Instruction 7041.3, "Economic Analysis of Proposed Department of Defense Investments," in December 1966. The Department of the Army published Army Regulation 37–13, "Investment for Savings—Economic Analysis of Proposed Army Investments," in April 1967. This regulation required that an economic analysis accompany each command and agency submission to Headquarters, Department of the Army, where the sole or primary justification for investment was economic and the cost was over $200,000. Its objective was to:

- Systematically identify and portray the economic costs and savings associated with each proposal, so that meaningful comparisons of alternative choices could be made.
- Highlight key variables and assumptions on which the economic analysis was based, and evaluate these assumptions in light of past experience and expected results.
- Analyze and evaluate proposed Army investments designed to achieve economy of operations.

Economic analysis was required for such decisions as the acquisition of automatic data processing equipment, consolidation projects for warehouses and depots, and modernization projects to improve work flow or increase capacity. The major emphasis in the investment for savings program was use of the present value (or discounting) technique. In this approach, estimates for alternate projects were evaluated not only with regard to the total costs involved, but also with regard to contemporary financial requirements.

Recognizing the need for renewed emphasis on systematic analysis, the Office of the Secretary of Defense issued a revised DOD Instruction 7041.3 in early 1969. The revised instruction substantially broadened the range of problems on which analysis would be applied.

In June 1969, a new Army Regulation 37–13, "Economic Analysis of Proposed Army Investments," was published. The term "investment" is used in a broad sense. The new regulation formally extends the requirement for systematic analysis into such fields as research projects and weapon systems.

The Army has long recognized the need for using sound analytical techniques in determining requirements and fully supports the underlying concepts of economic analysis. These techniques are sometimes referred to as cost benefit analysis, cost effectiveness analysis, tradeoff analysis, cost comparisons, systems analysis, etc.

There are major opportunities for making capital improvements within the Army, which can result in a net reduction in annual operating costs or, equally important, increased efficiency within available resources. Benefits from high quality systematic analysis will include increased readiness and better working conditions for both military and civilian personnel. Through automation, consolidation, and modernization of routine operations in support areas such as facilities and processing equipment, it will be possible to increase efficiency and accomplish much more within available resources. As in business, some Army proposals are well known and relatively easy to develop and justify. The identification and justification of others will require detailed study and careful, logical analysis.

Regulation 37–13

The Office, Comptroller of the Army, has overall Department of the Army staff responsibility for implementation of economic analysis and is the proponent for Army Regulation 37–13.

Because economic analysis cannot be separated from the benefits derived, close coordination is requred between the offices preparing economic analyses and systems-oriented organizations. Detailed coordination is, therefore, necessary with staff agencies responsible for the various aspects of research, development, procurement, and operation of Army equipment and forces. Accordingly, Army Regulation 37–13 provides only policy and general guidance, and procedures for preparation and use of economic analysis. Department of the

Army staff agencies and major Army field commands are responsible for providing more specific guidelines appropriate to their missions and functional organizational elements.

In viewing the application of economic analysis within the Army, several major characteristics stand out.

It was important that economic analysis be integrated into the existing decision process. Therefore, economic analysis has been applied within the framework of the existing Planning - Programming - Budgeting System. It is anticipated that economic analysis will have greatest utility in the planning and programming stages. At these stages, it serves as an aid in determining which projects should be undertaken. At the budget stage, when deciding how to support previously approved decisions, economic analysis has more limited application.

As a tool for decision makers, the value of economic analysis lies in its systematic approach to the consideration of alternatives rather than in mere quantification. Although it is necessary to estimate costs and benefits (inputs and outputs), a great deal of sound analysis can be performed without a knowledge of complicated techniques.

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Economic analysis is most useful when prepared by the people involved in operations and reviewed by the personnel having a primary interest in the project. In the field, economic analysis assists in identifying, supporting, and documenting program requirements. At the staff level, economic analysis provides a better basis for evaluating program proposals submitted within functional areas of responsibility.

Every defense manager has a commitment to ensure the effective utilization of resources. While economic factors are not the only considerations in selecting among alternatives, they are, however, important. Just as in the business community, Army investments made with the expectation of receiving certain benefits over an extended period of time should provide a return on investment. When funds cannot be made available for all requirements, those proposals that are approved must be those which provide the greatest overall benefits or utility.

Application

The Army approach to economic analysis program, is to:

- Determine methods of using economic analysis within the current structure of the Army Management System, with existing information systems and within current Army resources.
- Develop applicable methodology and analytical techniques in a form that can be used by an Army installation without extensive retraining of personnel. The methodology will be based on analytical techniques falling within the operations research/systems analysis area.
- Provide education and training in economic analysis to upgrade the skills of analysts. It is essential that personnel at all management and decision-making levels have an understanding of how systematic analysis can be useful in identification and justification of requirements.

Emphasis is being given to systematic analysis on spending proposals at the departmental level, as well as at lower command echelons of the Army. Steps taken by the Army Material Command (AMC) to establish an economic analysis program illustrate this emphasis.

From the start, AMC's thrust has been to emphasize the utility of economic analysis as a decision tool within the framework of the existing Planning-Programming-Budgeting System. First, AMC made a review to determine those areas which would provide the greatest immediate return. High priority was assigned to the area of military construction. Construction programs appeared tailor-made for the analytical approach called for in the economic analysis effort.

Examples of construction projects for which economic analyses have been prepared include:

- Whether to refurbish existing barracks for enlisted personnel, or to replace them with new construction.
- Whether to build a controlled environment facility for storing batteries and increasing shelf life, or to continue storage in open warehouses and experience deterioration.
- Whether to modernize depot maintenance facilities to meet expanded Army-wide requirements, or to meet them through contract, or merely to defer maintenance and extend the maintenance cycle.
- Whether to convert manually operated coal-fired boilers to automatic controlled oil-fired boilers, or to continue as is and incur high fuel, handling, and operating costs.

The Continental Army Command has applied economic analysis to purchases of data processing equipment and evaluation of fuel conversion projects. The Military Traffic Management and Terminal Service has used economic analysis to study conversion of port facilities to handle containerized freight and the economic feasibility of routing military cargo through Great Lakes ports.

Extensive monitoring of the economic analysis effort ensures that, for the first time, economic analyses will be performed on each applicable proposal before the requirement is approved and included in submissions to Headquarters, Department of the Army.

A program change request (PCR) is the vehicle by which the Service

Secretaries request changes to elements of the Five Year Defense Program. AMC headquarters has been deeply involved in initiating PCRs and in providing input to PCRs developed by Department of the Army headquarters. Economic analysis is now applied to both functional and commodity-oriented PCRs initiated by the Army, with the parameters prescribed by DOD Instruction 7041.3.

Commodity-oriented PCRs require economic analyses mainly to identify cost minimization or effectiveness maximization possibilities. Functionally oriented PCRs need economic analysis mainly to identify tradeoffs and/or cost reduction or cost avoidance considerations.

Qualitatively, the economic analysis of PCRs has had a very positive impact. Cost models (statistical and otherwise) have replaced empirical estimates. Documentation of data estimates has been greatly improved to include detailed analysis of the rationale, methodology, and computation behind these data estimates.

AMC is making use of economic analysis in other investment areas, *e.g.*, production base support, and re search and development facilities.

Other major Army field commands are aggressively improving their systematic analyses.

Upgrading Analytical Skills

Since the input to the economic analysis will most often be based on a cost estimate or cost study, the skills of the cost estimator or analyst are vital. The Army recognizes that if the quality and accuracy of cost estimates are to be improved, the skills of cost analysts need upgrading.

Because of the widespread and growing use of economic analysis, there is increased attention being given to this technique in the Army education program. An extensive portion of the Army Weapon System Acquisition Improvement Program is aimed at upgrading the expertise of analysts involved in determining weapon requirements. Army-wide, some examples of the current educational effort are courses related to economic analysis taught at the:

- Army Management Engineering Training Agency.
- Army Management School.
- Army Finance School.

In addition, briefings on the subject have been given, in the field and at Department of the Army headquarters, to broaden the understanding of involved Army personnel before establishing economic analysis efforts in various segments of the Army.

Contact with the academic community, other government agencies and especially, with the Office of the Secretary of Defense and the other military services will continue. This will produce a fruitful exchange of information.

Another effort is the preparation of a handbook on economic analysis by AMC. Research currently being conducted by Headquarters, Department of the Army, and research previously accomplished by AMC will play an integral role in the preparation of the handbook.

Areas of Emphasis

If economic analysis is to be used as widely as is anticipated, several areas appear to need considerable attention.

When mixes of systems over a period of time are studied, various systems may be phased in or out during that interval. These system composition fluctuations give rise to serious problems in costing applications and, thus, to discounting procedures. Evaluation of the following parameters would alleviate this problem:

- Economic (or useful) life of each system.
- Terminal value of each of those systems that reach the end of their economic lives during the given period of study.
- Residual value of each of those systems that have not attained the end of their economic lives at the conclusion of the given period of stud .

Studies on this aspect of economic analysis are now in progress at Headquarters, AMC, and Headquarters, Department of the Army.

Another foreseeable problem is in the area of present value analysis (discounting). The present value method of investment analysis requires a use of specific rate of return. Such a rate may be established either by policy decision or as a result of a systematic investigation of the value of capital. Currently, the DOD specified rate of return is 10 percent.

Possible alternatives to the fixed 10-percent rate for all types of investments are rates of return for broad categories of investment. For example, in the Army, these categories could be:

- Weapon systems and related support systems.
- Installation projects.
- Social overhead (Corps of Engineers Civil Works Program).

The rate of return on weapon systems should reflect the high degree of uncertainty involved in selection of useful systems capable of responding to enemy threats of varying proportions. The rate of return on Army installation projects should approach the industrial rate of return for similar activities. The social overhead rate of return might be directly related to the government interest rate.

The Army is now more determined than ever to assure that its expenditures are economically justified. Whether the economic problem is viewed as achieving a maximum level of effectiveness for a certain level of expenditures, or attaining some stated level of effectiveness at the minimum cost, the current environment emphasizes the need to achieve a maximum output for every dollar expended in the defense sector.

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GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from:
Superintendent of Documents
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Report of the Feasibility of Applying Uniform Cost-Accounting Standards to Negotiate Defense Contracts by the Comptroller General of the United States to the Committee on Banking and Currency, House of Representatives. A study required by Public Law 90-370 to determine feasibility of applying uniform cost accounting standards to all negotiated prime contract and subcontract defense procurements of $100,000 or more. January 1970. 558 p. Y4.B22/1:D36/4. $4.75.

Catalog of Publications, 1969, U.S. Naval Oceanographic Office. Listing of publications of interest to oceanographic, cartographic and maritime communities. 1969. 75 p. D203.22:1-P/969. 75¢.

What is an Observation? Description of the common usage of the term "observation" in relation to the Defense Contract Administration Services quality assurance program and management information reporting system. 1969. 96 p. D7.6/7:8200.1. $1.00.

MILSTRIP, Military Assistance Program Addresses, Change 3 to Supplement No. 2, Jan. 1, 1970. 25 p. D7.6/-4:M 59/supp. 2/ rev.-3/ch. 3. 25¢.

MILSCAP, Military Standard Contract Administration Procedures, Supplement No. 1, October 1969. 21 p. D7.6/4:M-59/3/supp. 1. 40¢.

MILSTRIP, Military Standard Requisitioning and Issue Procedures, Change 23, October 1969. 130 p. D7.6/4:M-59/ch. 23. $1.25.

MISTEP, Military Supply and Transportation Evaluation Procedures, Change 2, September, 1969. 24 p. D7.6/4:M 59/2/ch. 2. 30¢.

Army Procurement Procedure, Revision 2, Nov. 1, 1969. 139 p. D101.6/-4:969/rev. 2. $1.50.

DSA Field Establishment Directory. Lists DSA Supply Centers with their subordinate field structure; Defense Depots; DSA Service Centers and their subordinate field structure; Defense Contract Administration Services Regions and their subordinate field structure; and Headquarters DSA Field Extension offices. 1969. 29 p. D7.6/7:5025.2/7. 40¢.

Defense Industrial Plant Equipment Center Operations, Change No. 2, Oct. 30, 1969. 2 p. D7.6/8:4215.1/2/ch. 2. 5¢.

Management of Contractor Data and Reports, Volume II: Authorized Data List Change 2, Dec. 1, 1969. 118 p. D301.45/14:310-1/2/v.2/ch. $1.25.

RESEARCH REPORTS

Organizations registered for service may obtain microfiche copies of these documents without charge from:
Defense Documentation Center
Cameron Station
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All organizations may purchase microfiche copies (65¢) or full-size copies ($3) of the documents (unless otherwise indicated) from:
Clearinghouse for Federal and Scientific Information
Department of Commerce
Springfield, Va. 22151

All orders to the Clearinghouse must be prepaid.

PLASTEC Report 5C, Directory in Plastics, Knowledgeable Government Personnel (Revised). Plastics Technical Evaluation Center, Picatinny Arsenal, Dover, N.J., April 1969, 126 p. AD-692 997. (Available only in hard copy from the Clearinghouse for Federal and Scientific Information at $6 per copy.)

Polytetrafluoroethylene. Defense Documentation Center, Alexandria, Va., Nov. 1969, 93 p. AD-697 400.

The Effect of Surface Finishing on Structural Ceramic Failure. K. R. McKinney and C. M. Herbert, Naval Research Laboratory, Washington, D.C., Nov. 1969, 28 p. AD-697 923.

Foam Separation as a Tool in Chemical Oceanography. G. T. Wallace Jr. and O. F. Wilson, Naval Research Laboratory, Washington, D.C., Nov. 1969, 22 p. AD-697 924.

Thermal Radiation Shielding for High Temperatures. S W. Gouse Jr., et. al., Army Materials and Mechanics Research Center, Watertown, Mass., Aug. 1969, 28 p. AD-697 730.

Development of a Laboratory Technique for Defining Mechanical Shear Stabilities of Multi-Grade Engine Oils. M. E. Lepera and J. Pigliacampi, Army Aberdeen Research and Development Center, Aberdeen Proving Ground, Md., Nov. 1969, 28 p. AD-698 027.

Compressibility and Polymorphism of Solids. J. N. Plendl and P. J. M. Gielisse, Air Force Cambridge Research Laboratories, Bedford, Mass., Oct. 1969, 30 p. AD-698 331.

Electrical Noise in GaAs Diode Lasers. T. R. Royt, Naval Research Laboratory, Washington, D.C., Oct. 1969, 67 p. AD-698 281.

Electrical and Optical Properties of Lead-Tin-Telluride Semiconducting Alloys. R. F. Bis and J. R. Dixon, Naval Ordnance Laboratory, White Oak, Md., Sept. 1969, 110 p. AD-697 647.

DEFENSE PROCUREMENT CIRCULARS

Distribution of Defense Procurement Circulars is made automatically by the U.S. Government Printing Office to subscribers of the Armed Services Procurement Regulation (ASPR).

Defense Procurement Circular No. 77, March 23, 1970. (1) Equal Employment Opportunity. (2) "Setoff"—Defective Cost or Pricing Data.

Fuzes— Brains of Munitions

Lieutenant Colonel Peter E. Hexner, USA

Most modern weapon systems have as their main mission the delivery of an explosive to the enemy. In order to do this efficiently, the warheads of such systems, whether intercontinental ballistic missiles, antiballistic missiles, artillery projectiles, or grenades, must be detonated at some well defined point in space or time.

The component of the warhead which causes functioning at that optimum point, and thus determines the effectiveness of the total weapon system, is the fuze. Fuzes are aptly called the "brains of munitions." They have the unique capability to sense the proper condition for functioning. They determine position relative to the target, and cause warhead function.

In many cases, target damage caused by a weapon system is increased the closer the warhead is detonated to the intended target. Intuitively, the warhead should be in contact with the target at time of detonation. Unfortunately, for the wide class of weapon systems using high explosives, the cost of making every projectile hit the intended target is prohibitive. In fact, present technology precludes design of an air defense system, an aircraft armament system, or an artillery system which can guarantee direct hits, even if cost is ignored.

In the case of air-to-ground and ground-to-ground munitions, system efficiency is increased when the warhead detonates in proximity to the target. It turns out that in engaging personnel, or "soft" targets, maximum effectiveness is achieved when the high explosive warhead is detonated above the target. In engaging "hard" targets, such as tanks or armored personnel carriers, damage is maximized with certain munitions if the high explosive is detonated at some optimum distance away from the target. Even with nuclear munitions, fallout criteria, along with consideration of cost and effectiveness, make it desirable to detonate the warhead at some altitude above the surface.

Attempts at air defense systems which depend upon direct hits for effectiveness have been notoriously costly. For example, during World War II, the Navy fired nearly 4,000 rounds per direct hit on aircraft targets, even after automatic fire control equipment was used. While advances in radar guidance have generally kept pace with the sophistication of targets, they still have not overcome the high cost of ammunition if direct hits are required for mission success.

To reduce the extremely high cost of engaging air targets, a fuze was developed in World War II which sensed its position relative to the target. It was called the "funny fuze" by General George Patton. It is now known as the "proximity" or the "radar" fuze.

Proximity fuzes have progressed a long way since World War II when they depended on vacuum tubes for the electronic circuits. While they were originally considered to be rather esoteric devices, reserved for special situations due to their high cost and security classification, modern technology has made them cost effective over practically the complete spectrum of munitions from small 20mm projectiles up to the largest nuclear weapons. In fact, proximity fuzing has proven to be the best way to increase effectiveness of high explosive munitions for many targets, whether the cost be measured in dollars or tonnage.

This achievement did not develop by accident. It developed through good research, development and engineering by the Defense Department and private industry.

The Army Materiel Command's Harry Diamond Laboratories (HDL), located in Washington, D.C., have the prime responsibility for research in proximity fuzing techniques and for the development and engineering of fuzes for tactical use. In performing this mission, the Harry Diamond Laboratories provide the Army, as well as the Navy and the Air Force, a complete and in-depth capability in electronic fuzing.

Fuze Design Factors

When designing a fuze, several factors are considered: accuracy, reliability, safety and environmental hardness. These factors directly influence system effectiveness, producibility, storage life, and materials cost which, in turn, influence overall system cost.

The relative importance of each factor varies with the nature of the conflict and the warhead. During World War II, the increase in effectiveness gained by using proximity fuzes was so pronounced that production was initiated when one out of two research and development proto-

types functioned properly. Now that the nation is not engaged in a struggle for survival, the reliability standards are much higher, namely, proper function in at least 98 percent of the rounds.

In a similar vein, warheads vary in design and size. Some are quite large, requiring less absolute target resolution; others are small and require rather good resolution. Thus, not only do weapon designs change, but the criteria for satisfactory performance change and the relative importance of the factors change.

Accuracy. In order for the proximity fuze to detonate the warhead near the target, it must be capable of measuring the distance between the target and the warhead, comparing that distance with some predetermined value associated with the lethal radius of the warhead, and making the decision to detonate the warhead. So far, radar has proved to be the most effective means for measuring distance. With the advent of lasers and light emitting diodes, optical systems are being investigated. Sometimes they offer even better distance and direction resolution than radar systems.

Reliability and Safety. The factors of reliability and safety are obvious considerations in munitions design. The difficult part in fuze research and development is to design systems which are not only safe when handled and fired, but function reliably in the target area.

Environmental Hardness. Today's fuzes must survive a variety of severe environments. The classical tests of shaking, dropping, freezing, heating, and spraying salt water are still used. In addition, there are requirements for surviving severe accelerations imparted by artillery weapons, re-entry into the atmosphere, or the environment created by a nuclear weapon detonation.

All of these create special design problems and require broad research in materials and techniques. For example, the artillery environment imposes axial accelerations of 20,000 times the acceleration of gravity and higher, and rotation up to 350 revolutions per second. Re-entry vehicle fuzes must not only survive, but also function properly during deceleration and heating as they come back into the atmosphere. Nuclear weapons produce pronounced effects on electronic materials due to high fluxes of neutrons and x-rays. Introduction of new materials, components, and more stringent requirements makes environmental hardness an area requiring much further research.

Storage Life. Modern munitions are expected to last for extended periods of time with little or no maintenance in storage, and to function properly upon activation. Current goals are munitions which can remain in stockpile for 15 to 20 years and function perfectly upon demand.

This requires careful selection of materials and assembly techniques. It is particularly important in determining the components in fuze power supplies where chemicals, plastics, or solid state materials may change or interact in the course of time.

Producibility. It makes no sense to design a weapon system, especially one calling for high volume production, which requires unrealistic advances in the state of the art of industrial production, or requires manpower skills not readily available. Further, a design requiring high cost materials, or materials in short supply, should be avoided.

A major effort is oriented toward designing fuzes which are producible by highly automated assembly lines. As a result of continuing design effort, proximity fuzes can now be produced on an automatic assembly line.

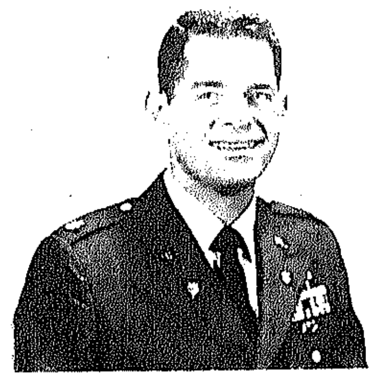
Cost. Production and employment costs of ammunition are perhaps the most significant factors considered in fuze design. They have been the overriding factors in much of the recent research effort at Harry Diamond Laboratories. Through microcircuit technology, integrated circuits, and good industrial design, a proximity fuze is now being produced for $5 in quantity production. Such a price makes the proximity fuzing of small caliber rounds practical and will allow a significant reduction in ammunition logistics.

Research and Development at HDL

After World War II, it was recognized that proximity fuze technology was in its infancy and that it was imperative to have a military laboratory maintain an effective program in fuze research. To this end, the Harry Diamond Laboratories (originally called the Diamond Ordnance Fuze Laboratories) was constituted and assigned the mission of conducting research and development to advance the state of fuzing technology, and to apply the knowledge gained to the wide scope of military ordnance problems. To accomplish this mission and to address the fuze design factors mentioned previously, HDL has been organized to perform fuze research and development from initial concept and feasibility demonstration, through development and design for production, to management of large scale production.

The technical director of HDL is Billy M. Horton. He is assisted by five associate directors who monitor specific areas.

To accomplish its research and development mission, HDL is divided into nine technical elements plus administrative support offices. Within the nine technical elements, there are four research laboratories in which the major emphasis is on advancing the state of the art. In these laboratories new ideas or old problem areas are explored, and new systems and components are investigated and produced for use in future generation



Lieutenant Colonel Peter E. Hexner, USA, was Commanding Officer of the Harry Diamond Laboratories at the time this article was written. Prior to his assignment to HDL, he served as Military Assistant in the Office of the Secretary of Defense. Colonel Hexner is a graduate of the Industrial College of the Armed Forces and holds a Ph.D. in physics from the University of Virginia.

levices. Working closely with the research laboratories are three development laboratories in which the major emphasis is directed toward incorporating newly developed systems and components into specific warhead fuze designs. The development laboratories translate state-of-the-art technology into detailed systems designs which meet the military requirements.

Concurrent with the design effort to meet technical requirements, the HDL Engineering Division reviews the design for production and coordinates with industry to establish production techniques necessary for large volume, low cost production. The ninth technical element of HDL is the Research and Engineering Support Division which provides necessary support for prototype model fabrication and environmental testing of new hardware items.

To adequately consider fuze design ictors, HDL conducts research in any diverse areas. Radio proximity izing is based upon radar system chniques and components. As a reilt of HDL's intensive research in idar fuzing, including electronic arfare techniques, significant adinces are being made not only in zing, but in personnel detection, air fense and counter battery radars. eed for specialized electronic compomnts requires research in solid state iysics, semiconductors, microwave mponents, integrated circuits, and tenna structures. Interest in optical nging systems has led to extensive search in infrared systems, light attering and attenuation phenoma, and in lasers and laser materials. uidic technology, which was origited at HDL, is investigated for fuzr applications, process controls dical devices, and weapon systems rectional controls.

Environmental considerations have to development of simulation techlues for the typical artillery tube vironment of high acceleration and n. Considerations of the nuclear liation environment have led into ensive radiation damage studies. so, HDL is presently conducting intigations into transient radiation ects on electronics (TREE) for the my and other services.

e of Industry

HDL's task of design, development and production of fuzes requires substantial support from industry. Industry is called upon to develop new materials (plastics, metals, semiconductors, etc.), new components (rf sources, power supplies, etc.), and new fabrication techniques to reduce labor costs. Without active and continuing participation by industry in all phases of fuze work, HDL could not effectively accomplish its job.

A significant contribution from industry is development of techniques for highly automated production of complex electronic devices. Such a capability has just recently been initiated with the XM596 fuze program. This is the $5 fuze, previously mentioned, used on 40mm projectiles fired by armed helicopters. It is a high volume production item whose low cost depends upon modern industrial facilities capable of automatic assembly. One of industry's contributions has been and will continue to be the design and operation of facilities for such automated production.

Future Trends

While it might seem that the XM596 approaches the epitome of fuze design from a cost effectiveness standpoint, it really is just a hint of what can be done. The techniques must be applied to the whole class of antipersonnel, antitank and antiaircraft fuzing which modern warfare demands. Continued emphasis on integrated circuits and microcircuit technology, along with automatic assembly techniques, will be necessary to push fuze costs even lower.

Increasing availability of solid state optical devices makes it possible to consider the development of direction sensitive fuzes. This will enable the fuze to not only sense distance but also direction to the target. Coupled to a suitably designed aimable warhead, such fuzes could prove to be extremely effective. The major current problems are high cost and limited power capabilities of light sources.

Another area of immediate interest is multiuse and multifunction fuzes. It would be desirable to develop a fuze for a wide class of projectiles (multiuse) and incorporate into it not only a proximity function but time and impact functions. Such a fuze would decrease costs, obtain the advantage of very large volume production, reduce logistic requirements, training, and all factors that come into the use of munitions. Besides the obvious savings in production, fuze function could be literally dialled by a gunner or specified by an automatic fire control system.

Finally, an area which is basic to all fuzes is the development of power sources. New methods are required for converting mechanical, aerodynamic, chemical, or even nuclear energy into usable fuze power.

It is to these and a myriad of other problems that the Harry Diamond Laboratories will devote its resources so that the "brains of munitions" will become smarter and cost less.

USAF Using Laser in Wind Tunnel Tests

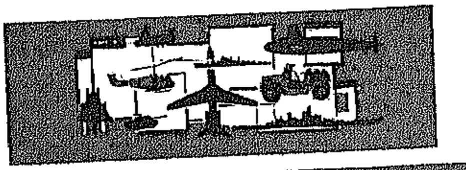
Predicting shapes for future jet aircraft capable of speeds six times the speed of sound—about 4,000 miles per hour—requires an understanding of the airflow around the aircraft. The Air Force's Arnold Engineering Development Center (AEDC), Arnold AFS, Tenn., is using a laser light source to see a cross sectional view of an aircraft model's entire air flow.

One major change is made from previous visualization techniques. Instead of heating the air before it enters the high speed wind tunnel, the air is left cool. Inside the tunnel, water vapor in the air condenses to form a fog-like condition.

A continuous wave ruby laser is then beamed through a vertical slit, and across the test section, creating a curtain of light illuminating the liquified water vapor, as car headlights illuminate fog.

Swivel mounted, the laser can scan the model from nose to tail. Changes in airflow around the model produces contrasting patterns of the shock wave and other turbulent air flow. A camera aimed through a window on the other side of the tunnel scans the model along with the laser to record the illuminated pattern of the shock wave.

Tests are being conducted for the Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, by technicians of ARO, Inc., contract operator of AEDC.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of April 1970.

DEFENSE SUPPLY AGENCY

2—Drexel Dynamics Corp., Horsham, Pa. $1,586,484. 268 electric fork lift trucks, 4,000-pound capacity. Defense General Supply Center, Richmond, Va. DSA 400-70-C-4610.

20—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for fuel oil and gasoline:

Gulf Oil Co., Houston, Tex. $2,233,475. DSA 600-70-D-1427.

Atlantic Richfield Co., Chicago, Ill. $3,095,162. DSA 600-70-D-1359.

APCO Oil Co., Oklahoma City, Okla. $1,195,723. DSA 600-70-D-1357.

24—Texaco Inc., Long Island City, N.Y. $1,131,169. Fuel oil and gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1451.

28—American Oil Co., Chicago, Ill. $1,353,831. Gasoline and fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1356.

DEPARTMENT OF THE ARMY

1—McGinnes Brothers, Inc., Houston, Tex. $2,199,510. Construction of the Catahoula Lake Diversion gated control structure, Ouachita and Black Rivers, Arkansas and Louisiana Project. LaSalle Parish, La. Army Engineer District, Vicksburg, Miss. DA-CW38-70-C-0108.

2—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts for metal parts for fuzes:

KDI Precision Products, Inc., Cincinnati, Ohio. $2,384,000. M427. DA-AA09-70-C-0343.

General Time Corp., LaSalle, Ill. $1,557,360. M423. DA-AA09-70-C-0342.

Gibbs Manufacturing and Research Corp., Janesville, Wis. $1,586,500. M423. DA-AA09-70-C-0341.

Hamilton Watch Co., Lancaster, Pa. $1,486,800. M423. DA-AA09-70-C-0340.

AVCO Corp., Richmond, Ind. $2,846,250. M423 and M427. DA-AA09-70-C-0339.

3—C. R. Frederick, Inc., Novato, Calif. $1,459,900. Construction of a 2,200-foot concrete channel, Walnut Creek Channel Improvement Project, Contra Costa County, Calif. Army Engineer District, Sacramento, Calif. DA-CW05-70-C-0080.

—H/R Products, Inc., South Bend, Ind. $1,114,682. Type G lifting plugs for 155mm, 175mm and 8-inch projectiles. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0344.

—Thiokol Chemical Corp., Woodbine, Ga. $1,024,500. CS-XM15 riot control agent cluster canisters. Edgewood Arsenal, Md. DA-AA15-70-C-0368.

—General Dynamics Corp., San Diego, Calif. $2,455,092. Prototype models of a classified sensing agent. Procurement Div., Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0198.

—Philco-Ford Corp., Philadelphia, Pa. $1,579,760. Engineering, fabricating and installing a Foresight Sierra Communication System, plus literature, tools and test equipment. Philadelphia and Fort Washington, Pa. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0007.

6—Control Data Corp., Bethesda, Md. $1,191,412 (contract modification). Leased portion of the Tactical Operations Systems, Hq., USAREUR, Heidelburg, Germany. Procurement Div., Army Electronics Command, Washington, D.C. DA-AB09-67-C-0014.

7—Dravo Corp., S. J. Groves and Sons, Inc., C. H. Leavell, Fischbach and Moore, N. A. Degerstrom and Max J. Kuney Co., (joint venture) Bellevue, Wash. $17,407,968. Construction work and installation of equipment for the powerhouse, Dworkshak Reservoir Project, Clearwater County, Idaho. Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0079.

8—Rome Plow Co., Cedartown, Ga. $1,554,348. 208 hydraulic tree dozers, size 2. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-6337.

—Bell Helicopter Co., Amarillo, Tex. $1,686,554. Repair of AH-1G crash-damaged aircraft. $2,911,021. Repair of UH-1 series crash damaged aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-D-0056.

—Batesville Manufacturing Co., Batesville, Ark. $1,557,270. Metal parts for M904E2 bomb fuzes. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0370.

9—General Electric Co., Portland, Ore. $1,184,025. Design, manufacture and installation of two 26,200 KVA generators. Schenectady, N.Y., and Snettisham Project, Alaska. Army Engineer District, Anchorage, Alaska. DA-CW85-70-C-0011.

10—Slate-Hall, Portland, Ore. $1,475,879. Construction of 2¾ miles of highway and viewpoint, Lost Creek Reservoir, Rogue River Project, Jackson County, Ore. Army Engineer District, Portland, Ore. DA-CW57-70-C-0107.

—J. S. Alberici Construction Co., Inc., and Associate Engineer Co., (joint venture) St. Louis, Mo. $3,873,827. Pollution control—water distribution plant, Army Ammunition Plant, Newport, Ind. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0055.

—Maxson Electronic Corp., Macon, Ga. $5,069,228. 66mm 4-round clips, XM74. Edgewood Arsenal, Md. DA-AA15-70-C-0373.

—H. O. Boehme, Inc., Westbury, N.Y. $1,570,472. AN/ASN-43 gyromagnetic compass sets and ancillary items. Army Electronics Command, Fort Monmouth, N. J. DA-AG07-69-C-0024.

—Raytheon Co., Andover, Mass. $1,020,000 (contract modification). Engineering services for the Improved Hawk missile system. Andover and Bedford, Mass., and White Sands Missile Range, N. M. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0195.

—The following contracts were issued by the Army Ammunition Procurement and Supply Agency, Joliet, Ill.:

Medico Industries, Inc., Wilkes-Barre, Pa. $1,489,500. Metal parts for 2.75 inch rocket warheads, M151. DA-AA09-70-C-0360.

Chamberlain Manufacturing Co., Waterloo, Iowa. $1,512,000. Metal parts for 2.75 inch rocket warheads, M151. DA-AA09-70-C-0358. $1,825,560. Metal parts for 2.75 inch rocket smoke warheads, M156. DA-AA09-70-C-0364.

Lehigh, Inc., Easton, Pa. $1,470,000. Metal parts for rocket warheads. DA-AA09-70-C-0359.

Airport Machining Corp., Martin, Tenn. $1,586,000. Metal parts for rocket warheads, M151. Union City, Tenn. DA-AA09-70-C-0357.

Bulova Watch Co., Valley Stream, N.Y. $3,508,820 (contract modification). Metal parts for 81mm point detonating fuzes, M524A6. DA-AA09-70-C-0100.

13—Norris Industries, Inc., Los Angeles, Calif. $4,125,600 (contract modification). 2.75 inch rocket motor tubes. Pico Rivera, Calif. Picatinny Arsenal, N.J. DA-AA21-70-C-0244.

—Northrop Corp., Anaheim, Calif. $3,437,500 (contract modification). 2.75 inch rocket warheads, WDU 4A/A. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0132.

14—Colt's, Inc., Hartford, Conn. $1,290,678 (contract modification). 5.56mm rifles, M16A1. Army Weapons Command, Rock Island, Ill. DA-AF03-70-C-0001.

—Sylvania Electronic Systems Inc., Mountain View, Calif. $1,800,000 (contract modification). Classified study. Army Security Agency, Vint Hill Farms, Va. DA-HC07-69-C-0247.

15—IBM Corp., White Plains, N.Y. $3,000,000. Classified electronics. San Jose, Calif. Army Electronics Command, Fort Monmouth, N.J.

—Bell Helicopter Co., Fort Worth, Tex. $9,742,849. AH-1J helicopters. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-C-1928.

—Eugene Luhr and Co., Columbia, Ill. $2,887,500. Excavating work, Kaskaskia River Navigation Project, Randolph County, Ill. Army Engineer District, St. Louis, Mo. DA-CW43-70-C-0180.

—General Motors Corp., Indianapolis, Ind. $4,333,736 (contract modification). Adjustment to the engineering design test program for the Main Battle Tank, XM-803. Cleveland, Ohio, and Milwaukee, Wis. Army Tank Automotive Command, Warren, Mich. DA-20-113-AMC-08843 (T).

16—Umpqua River Navigation Div., Bohemia Lumber Co., Inc., Eugene, Ore. $1,094,400. Repair of the north jetty, Coos Bay, Ore. Army Engineer District, Portland, Ore. DA-CW57-70-C-0108.

—General Motors Corp., Indianapolis, Ind. $2,165,545 (contract modification). Research and development and interim ad-

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

vance production engineering effort on the Main Battle Tank. Milwaukee, Wis., Cleveland, Ohio, Indianapolis, and Muskegon and Warren, Mich. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-5272.
Calif. $2,449,000. Performance on Phase I, Controllable Solid Rocket Program. Safeguard System Command, Huntsville, Ala. DA-HC60-70-C-0063.

—**Holloway Construction Co.**, Wixon, Mich. $6,569,456. Construction of an earth and rock filled dam and appurtenant works, Paint Creek Reservoir Project, Ohio. Army Engineer District, Huntington, W.Va. DA-CW69-70-C-0045.

17—**Cornell Laboratories**, Buffalo, N.Y. $1,800,000 (contract modification). Terminal discrimination study. Safeguard System Command, Huntsville, Ala. DA-HC60-69-C-0109.

—**Beech Aircraft Corp.**, Wichita, Kan. $12,327,434. RU-21E fixed wing utility aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0518.

—**International Harvester Co.**, Southfield, Mich. $1,432,134. Maintenance and telephone maintenance trucks. Springfield, Ohio, Fort Wayne, Ind., St. Louis, Mo., and Berkeley, Calif. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3348.

—**Magline, Inc.**, Philadelphia, Pa. $2,275,262. Second-year increment to three-year contract for electrical equipment shelters. Standish, Mich. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-69-C-0114.

20—**Hughes Aircraft Co.**, Culver City, Calif. $3,775,000 (contract modification). Repair parts for the TOW weapon system. El Segundo and Culver City, Calif. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0318.

—**Rogers Construction Co., and Babler Brothers**, (joint venture) Anchorage, Alaska. $1,994,282. Construction of centerline runway lighting and resurfacing of primary runway and taxiway, Elmendorf AFB, Alaska. Army Engineer District, Anchorage, Alaska. DA-CA85-70-C-0063.

21—**Western Electric Co.**, New York, N.Y. $1,549,410. Communications system, Kwajalein Missile Range. Winston Salem, N.C. Safeguard System Command, Huntsville, Ala. DA-HC60-70-C-0057.

22—**Warren Brothers Co., Ashland Oil, Inc.**, Memphis, Tenn. $1,972,700. 200,000 squares of articulated concrete mattresses for channel improvement revetment for the Mississippi River and Tributaries Flood Control Project. West Feliciana Parish, La. Army Engineer District, New Orleans, La. DA-CW29-70-C-0200.

—**Amis Construction Co.**, Oklahoma City, Okla. $5,900,000. Embankment construction, Lake Kemp Reservoir, Wichita River, Tex. Baylor County, Tex. Army Engineer District, Tulsa, Okla. DA-CW56-70-C-0112.

23—**Hughes Aircraft Co.**, Culver City, Calif. $1,725,000. Night vision systems, AN/ASQ-132, installed in UH-1M helicopters. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-69-C-0348.

24—The following contracts were issued by the Picatinny Arsenal, Dover, N.J.:

Marquardt Co., Ogden, Utah. $8,176,400 (contract modification). Nozzle and fin assemblies for 2.75 inch rockets. Clearfield, Utah. DA-AA21-70-C-0210.

FTC Corp., Denver, Colo. $2,443,500 (contract modification). 2.75 inch rocket nozzle and fin assemblies. DA-AA21-70-C-0211.

Jackson Products Co., Tampa, Fla. $3,134,700 (contract modification). 2.75 inch rocket nozzle and fin assemblies. DA-AA21-70-C-0213.

Hoffman Electronics Corp., El Monte, Calif. $2,816,250. Fin and nozzle assemblies for 2.75 inch rockets. DA-AA21-70-C-0530.

28—**Sanders Associates**, Bedford, Mass. $1,268,778, and $4,329,785. FY 1970 pilot production engineering services and FY 1970 production engineering services for Forward Area Alerting Radar (FAAR). Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0996 and DA-AH01-70-C-0997.

—**Pace Co.**, Memphis, Tenn. $2,277,626. White Star parachute illumination signals, M127A1. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0381.

—**Gulf and Wesern Industries**, Waukesha, Wis. $3,192,050. 40mm cartridge cases, M118. Antigo and Waukesha, Wis. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0128.

—**Ralph M. Parsons Co.**, Los Angeles, Calif. $1,396,895 (contract modification). Continuation of architect engineer services for preparation of a standard design for Safeguard missile radar sites and adaptation to the Grand Forks, N.D., site. Army Engineer Division, Huntsville, Ala. DA-CA87-68-C-0001.

29—**Olin Corp.**, East Alton, Ill. $1,304,983 (contract modification). 81mm illuminating projectiles, M301A3. Marion, Ill. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0108.

—**Texas Instruments, Inc.**, Dallas, Tex. $1,750,000. Classified. Dallas and Sherman, Tex. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0453.

—**Chrysler Corp.**, Sterling Heights, Mich. $1,259,293 (contract modification). Industrial plant equipment for medium tank mobilization planning, Detroit Arsenal. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-4363.

30—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Hercules, Inc., Wilmington, Del. $6,786,735 (contract modification). Operation of propellant facilities, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-00037(A).

Uniroyal, Inc., New York, N.Y. $3,189,300 (contract modification). Operation of production facilities, Army Ammunition Plant, Joliet, Ill. DA-11-173-AMC-00062(A).

Harvey Aluminum Sales, Inc., Torrance, Calif. $9,135,681 (contract modification). Operation of facilities, Army Ammunition Plant, Milan, Tenn. DA-11-173-AMC-00520(A).

Olin Corp., Stamford, Conn. $5,146,297 (contract modification). Operation of Army Ammunition Plant, Baraboo, Wis. $9,965,032 (contract modification). Operation of component and propellant facilities, Army Ammunition Plant, Charlestown, Ind. DA-AA09-69-C-0014.

E. I. Dupont de Nemours and Co., Wilmington, Del. $1,064,840. 7,000,000 pounds of TNT. Barksdale, Wis. DA-AA09-70-C-0368.

National Presto Industries, Inc., Eau Claire, Wis. $6,606,800. Metal parts for 105mm high explosive projectiles, M1. DA-AA09-69-C-0028.

Heckthorn Manufacturing Co., Dyersburg, Tenn. $3,336,683. 40mm high explosive projectiles, M406. DA-AA09-70-C-0262.

Eisen Brothers, Inc., Lodi, N.J. $1,657,096. 40mm projectiles, M406. DA-AA09-70-C-0077.

Chamberlain Manufacturing Co., Elmhurst, Ill. $13,209,150 (contract modification). Metal parts for 175mm projectiles, M437. Scranton, Pa. DA-AA09-70-C-0131.

Norris Industries, Inc., Los Angeles, Calif. $1,910,452 (contract modification). Metal parts for 105mm cartridge cases, M14B1. Army Ammunition Plant, Riverbank, Calif. DA-AA09-70-C-0167.

—**RCA**, Van Nuys, Calif. $2,195,944. Classified. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0406.

—**Koehring Co.**, Newton, Iowa. $1,277,076. Wheel mounted ditching machines. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-67-C-1477.

—**Globe Construction Co.**, Aurora, Colo. $1,095,670. Construction of a primary substation (10,000 KVA), storage and miscellaneous buildings, trailer park, and inspection facilities, Lake City Army Ammunition Plant, Independence, Mo. Army Engineer District, Omaha, Neb. DA-CA41-70-B-0081.

DEPARTMENT OF THE NAVY

1—**Litton Systems, Inc.**, College Park, Md. $1,322,999. AN/ALT-27 countermeasures transmitting sets and ancillary items. Naval Air Systems Command, Washington, D.C. N00019-70-C-0484.

—**Sante Fe Engineers, Inc.**, Lancaster, Calif. $2,037,400. Construction of an aircraft parking apron and air start system, Marine Corps Air Station, Yuma, Ariz. Naval Facilities Engineering Command, Washington, D.C. N62473-70-C-0101.

2—**United Aircraft Corp.**, East Hartford, Conn. $11,312,838 (contract modification). J-52-P-408 and J-52-J-8A aircraft engines. Naval Air Systems Command, Washington, D.C. N00019-70-C-0208.

—**Litton Systems, Inc.**, Melville, N.Y. $3,407,124. Omega timing and control sets. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-0533.

—**Ryan Aeronautical Co.**, San Diego, Calif. $1,285,975. Equipment for BQM-34A target drones. Naval Air Systems Command, Washington, D.C. F04606-70-A-0057.

—**Associates Plumbing Co.**, Santee, Calif. $1,244,816. Repair of fuel storage facilities, Naval Supply Center, Pearl Harbor, Oahu, Hawaii. Naval Facilities Engineering Command, Washington, D.C. N62471-70-C-0288.

3—**Johns Hopkins University**, Silver Spring, Md. $4,216,189 (contract modification). Advanced research on surface missile systems. Naval Ordnance Systems Command, Washington, D.C. NOw 62-0604-C.

—**IBM Corp.**, Owego, N.Y. $2,317,213. Spare parts for navigational and flight instruments for A-7E aircraft. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-A-4103-0001.

—**Kaman Corp.**, Bloomfield, Conn. $2,234,480. Main rotary wing blades for UH-2 and HH helicopters. Bloomfield and Moosup, Conn. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-A-0101-0003.

—**Singer-General Precision Inc.**, Binghampton, N.Y. $5,319,000. RF-4E weapon system trainers, 2F97. Binghampton and Sunnyvale, Calif. Naval Training Device Center, Orlando, Fla. N61339-70-C-0009.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

PRD Electronics, Inc., Jericho, N.Y. $3,354,561 (contract modification). Versatile Avionics Shop Test (VAST) building blocks and data transfer units. N00019-68-C-0449.

Jet Electronics and Technology, Inc., Grand Rapids, Mich. $1,397,319. Vertical reference gyro indicators. N00019-70-C-0354.

United Aircraft Corp., East Hartford, Conn. $8,739,922. TF-30-P-412 engines for the F-14A aircraft. N00019-70-C-0208.

6—**Ingalls Shipbuilding Div., Litton Industries, Inc.**, Pascagoula, Miss. $12,482,300 (contract modification). Overhaul and alteration of the USS Guardfish, SSN-612. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0281.

—**Zisken Construction Co.**, Chicago, Ill. $2,024,167. Construction of receiving barracks, Naval Training Center, Great Lakes, Ill. Naval Facilities Engineering Command, Washington, D.C. N62466-69-C-0350.

8—The Naval Air Systems Command, Washington, D.C., awarded the contract modifications:

Grumman Aerospace Corp., Bethpage, N.Y. $4,316,667. F-14A maintenance trainer. $1,100,000. Long lead time items for the FY 1971 F-14A aircraft program. N00019-69-C-0422.

McDonnell Douglas Corp., Long Beach, Calif. $2,776,000. TA-4J and A-4M aircraft. N00019-67-C-0170.

10—**FTS Corp.**, Denver, Colo. $2,878,595. Wing assemblies, Mk 1 Mod 0, Mk 4 Mod 0, and Mk 5 Mod 0, for Chapparal and Sidewinder missiles. Naval Ordnance Station, Louisville, Ky. N00197-70-C-0437.

—**Bethlehem Steel Corp.**, Terminal Island, Calif. $1,460,219. Overhaul of the USS Mispillion, AO-105. Supervisor of Shipbuilding, Conversion and Repair, Eleventh Naval District, Long Beach, Calif. N62791-70-B-0048.

—**Austin Electronics**, Roselle, N.J. $1,325,-000. Submarine periscope training device, 21A39/3. Naval Training Device Center, Orlando, Fla. N61339-70-C-0210.

—**Singer-General Precision**, Silver Spring, Md. $4,990,000. Dual position, P-3C Directional Finding and Ranging (DIFAR) operator trainers, 14B. Naval Training Device Center, Orlando, Fla. N61339-69-C-0260.

13—**McDonnell Douglas Corp.**, St. Louis, Mo. $39,405,000 (contract modification). Long lead time items to support procurement of F-4E, RF-4E and F-4J aircraft for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-68-C-0495.

—**Sanders Associates, Inc.**, Nashua, N.H. $1,-000,000. Anti-missile integrated defense data transfer and correlation system for fleet evaluation. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5460.

14—**Raytheon Co.**, North Dighton, Mass. $3,-833,927. Production of signal data converters, Mk 72, Mods 0 and 1. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2310.

—**North American Rockwell Corp.**, Columbus, Ohio. $3,000,000 (contract modification). Long lead time items for procurement of OV-10C aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0696.

16—**Pratt and Whitney Aircraft Div., United Aircraft Corp.**, East Hartford, Conn. $6,-009,141. Spare parts to support J-52 aircraft engines, and modification kits and spare parts for TF-30-P8 engines for A-7A/B aircraft. Naval Aviation Supply Office, Philadelphia, Pa. N00383-0-69000A.

—**Northrop Corp.**, Newbury Park, Calif. $2,-425,000. MQM-74A target drones. Naval Air Systems Command, Washington, D.C. N00019-70-C-0424.

—**Litton Systems, Inc.**, Woodland Hills, Calif. $1,453,173 (contract modification). Carrier Aircraft Inertial Navigation Systems (CAINS). Naval Air Systems Command, Washington, D.C. N00019-69-C-0582.

17—**Edo Corp.**, College Point, N.Y. $5,237,538. Conversion kits for Mk 82 Mod 0 underwater mines, and related production assemblies. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1419.

—**Bendix Corp.**, Baltimore, Md. $3,058,751. Transponder sets and mountings. Naval Air Systems Command, Washington, D.C. N00019-70-C-0471.

21—**Grumman Aerospace Corp.**, Bethpage, N.Y. $15,800,000 (contract modification). Long lead time parts and effort for A-6E aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0075 Mod P00012.

—**Raytheon Co.**, Lexington, Mass. $2,310,-868 (contract modification). AIM-7E and AIM-7E-2 Sparrow missiles. Lowell, and Bedford, Mass., Bristol, Tenn., and Oxnard, Calif. Naval Air Systems Command, Washington, D.C. N00019-69-C-0358.

—**ITT Corp.**, Nutley, N.J. $1,180,000. Four AN/URN-20 radio sets. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-2547.

22—**Westinghouse Electric Corp.**, Washington, D.C. $1,272,323 (contract modification). Launcher trainer equipment for Poseidon weapon system. N00030-69-C-0212. $2,-903,425. Launcher closures for Poseidon weapon system. N00030-69-C-0105. Sunnyvale, Calif. Naval Strategic Systems Project Office, Washington, D.C.

—**Sparton Corp.**, Jackson, Mich. $3,238,537. AN/SSQ-47B sonobuoys. DeLeon Springs, Fla. Naval Air Systems Command, Washington, D.C. N00019-70-C-0465.

—**General Electric Co.**, Washington, D.C. $10,000,000. Poseidon fire control and guidance support equipment. Pittsfield, Mass. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0127.

23—**Sperry Rand Corp.**, Salt Lake City, Utah. $4,285,739. Guidance sections for Shrike missiles for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-0472.

24—**Western Electric Co.**, New York, N.Y. $9,-692,516. Engineering services for a classified project. Winston Salem, N.C. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3534.

—**Bulova Watch Co., Inc.**, Valley Stream, N.Y. $1,148,815. Proximity fuzes, VT Mk 71 Mod 11/12, Mk 72 Mod 12/13 and Mk 73 Mod 4/5. Naval Ships Parts Control Center, Mechancisburg, Pa. N00104-70-C-A135.

27—**Raytheon Co.**, Bedford, Mass. $3,294,730 (contract modification). Guidance and control sections for Sparrow III missiles. Lowell and Bedford, Mass., Oxnard, Calif., and Bristol, Tenn. Naval Air Systems Command, Washington, D.C. N00019-68-C-0386.

—**Gibbs and Cox Corp.**, New York, N.Y. $1,-770,947. Engineering design services and construction of four technical ship models of an advanced amphibious assault landing craft. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0274.

—**Curtiss-Wright Corp.**, Wood-Ridge, N.J. $1,484,400. Product support engineering services for J-65 series engines. Naval Air Systems Command, Washington, D.C. N00019-70-C-0254.

—**Lockheed Aircraft Corp.**, Sunnyvale, Calif. $1,376,652. Engineering and field engineering services for the Polaris weapon system. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0136.

28—**Davidson Fabricating Inc.**, Collingdale, Pa. $1,016,366. Mechanical mine sweeping gear, Mk 103 Mod 1., and component parts. Colwyn, Pa. Naval Ordnance Station, Louisville, Ky. N00197-70-C-0449.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

LTV Aerospace Corp., Dallas, Tex. $82,-500,000 (contract modification). Long lead time for Air Force A-7D aircraft. N00019-67-C-0143.

Thiokol Chemical Corp., Huntsville, Ala. $4,442,480. Rocket motors and igniters for the Navy and Army. N00019-70-C-0336.

Grumman Aerospace Corp., Bethpage, N.Y. $6,350,000. Modification of A-6A aircraft to the KA-6D configuration. Stuart, Fla., and Bethpage and Calverton, N.Y. N00019-70-C-0458.

30—**Dynell Electronics Corp.**, Melville, N.Y. $2,262,548. AN/SPS-40B radar systems and modification kits. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1329.

—**Vitro Corp. of America**, Silver Spring, Md. $2,753,233. Configuration management program for a antisubmarine warfare defense program. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1416.

DEPARTMENT OF THE AIR FORCE

1—**General Motors Corp.**, Milwaukee, Wis. $2,-187,120. Titan IIIC inertial guidance systems. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-68-C-0065.

—**Raytheon Co.**, Burlington, Mass. $1,874,-000. Supplies and services applicable to the 440L electromagnetic system. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass.

3—**Control Data Corp.**, Minneapolis, Minn. $1,321,519. Automatic data processing equipment for Patrick AFB and Cape Kennedy AFS, Fla. Procurement Office, Air Force Eastern Test Range, Patrick AFB, Fla. F08650-70-M-K666.

—**The Boeing Co.**, Wichita, Kan. $2,700,600. Development of a prototype modification kit for B-52D/G/H aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F43601-70-C-2772.

—**Martin Marietta Corp.**, Orlando, Fla. $1,-107,947. AN/GSC-24(V) multiplexer equipment. Rome Air Development Center, Griffis AFB, N.Y. F30602-70-C-0143.

—**Dynamics Corp. of America**, Long Island City, N.Y. $1,291,600. Repair and modification of mobile ground communications equipment, AN/MRC-105. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-A-0345-0040.

6—**Cessna Aircraft Co.**, Wichita, Kan. $1,-432,998. A-37B aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-68-C-1290.

7—**North American Rockwell Corp.**, Anaheim, Calif. $42,023,426. Minuteman III post boost propulsion subsystems. Space and Missile Systems Organization, Los Angeles, Calif. F04701-68-C-0280.

8—**United Aircraft Corp.**, Stratford, Conn. $1,684,000. Spare parts for CH-3 and CH-53 helicopters. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-A-0003.

—**The Boeing Co.**, Wichita, Kan. $1,193,941. Maintenance of B-52 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-C-3987.

9—**Lockheed Aircraft Corp.**, Marietta, Ga. $7,362,510. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF 33657-15053.

—**Litton Systems, Inc.**, Woodland Hills, Calif. $3,266,550. Repair of F-4 aircraft gyroscopes. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F04606-69-A-0203.

—**Control Data Corp.**, Minneapolis, Minn. $1,792,476. 12 months' estimated maintenance and leasing costs of electronic data processing equipment for the Cambridge Research Laboratories, Bedford, Mass. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass.

10—**IBM Corp.**, Cape Canaveral, Fla. $1,806,-826. Rental and maintenance of automatic data processing equipment at Patrick AFB, Fla. Air Force Eastern Test Range, AFSC, Patrick AFB, Fla. F08650-70-M-0053.

—**McDonnell Douglas Corp.**, Huntington Beach, Calif. $1,597,121 (contract modification). Research on the Advanced Ballistic Reentry System (ABRES). Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0141.

13—**General Dynamics Corp.**, Fort Worth, Tex. $21,657,775. F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33657-13404.

14—**Control Data Corp.**, Minneapolis, Minn. $1,088,000. Rental of data processing equipment at Wright-Patterson AFB, Ohio. 2750th Air Base Wing, Wright-Patterson AFB, Ohio. F33600-70-F-6143.

15—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Electric Co., West Lynn, Mass. $3,482,800. J-85 turbojet engines. F33657-70-C-0229.

Hazeltine Corp., Little Neck, N.Y. $2,-621,258. $7,621,258. Radar equipment for F-4D aircraft. Greenlawn, N.Y. F33657-70-C-0942.

16—**IBM Corp.**, Kingston, N.Y. $1,688,080 and $3,027,927. Purchase of leased data processing equipment. 2750th Air Base Wing, Wright-Patterson AFB, Ohio. F33600-70-F-6180 and F33600-70-F-6170.

—**Collins Radio Co.**, Cedar Rapids, Iowa. $4,-086,836. Modification kits for mobile communications equipment. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-2039.

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'exas Instruments, Inc., Dallas, Tex. $21,-67,921. Bomb guidance kits. Aeronautical Systems Division, AFSC, Wright-'atterson AFB, Ohio. F33657-70-C-0254.

BM Corp., Dayton, Ohio. $1,858,049 and 1,133,000. Rental of data processing quipment at Wright-Patterson AFB, 'hio. 2750th Air Base Wing, Wright-atterson AFB, Ohio. F33600-70-F-6175 nd F33600-70-F-6176.

perry Rand Corp., Washington, D.C. $9,-35,807 and $1,866,769. Automatic data rocessing equipment. 2750th Air Base 'ing, Wright-Patterson AFB, Ohio. 33600-70-F-6354 and F33600-70-F-6355.

SL, Inc., Sunnyvale, Calif. $1,079,581. evelopment and fabrication of an in-lligence data collection system. Rome ir Development Center, AFSC, Grifils FB, N.Y. F30602-70-C-0230.

ercules, Inc., Wilmington, Del. $1,378,-9 (contract modification). Stage III finuteman II missile motors. Space and issile Systems Organization, AFSC, Los ngeles, Calif. AF04(694)-903.

ıe Aeronautical Systems Division, AFSC, 'right-Patterson AFB, Ohio, issued the llowing contracts:

Conductron Corp., St. Charles, Mo. $6,-406,971. A-7D aircraft simulators. F33657-69-C-0628.

AAI Corp., Cockeysville, Md. $1,070,000. AN/APM-307 electronic equipment for testing F-4 series aircraft fire control systems. F33657-70-C-0808.

ıe Aeronautical Systems Division, AFSC, right-Patterson AFB, Ohio, issued the llowing contracts:

Cornell Aeronautical Laboratories, Inc., Buffalo, N.Y. $2,400,000. Analysis of penetration aids for manned aircraft. F33615-70-C-1873.

Sylvania Electronic Systems, Inc., Need-ıam Heights, Mass. $2,756,264 (contract modification). AN/PRC-90 portable multi-channel radios. F33657-70-C-0405-P002.

ckheed Aircraft Corp., Marietta, Ga. 500,730. Spare parts for C-5A air-ıft. Detachment 81, San Antonio Air teriel Area, AFLC, Marietta, Ga. AF 057)15053.

ıeral Electric Co., Cincinnati, Ohio. 700,788. Spare parts for TF-39 engines C-5A aircraft. Evendale, Ohio. San tonio Air Materiel Area, AFLC, Kelly B, Tex. AF33(657)-15003.

:kheed-Georgia Co., Marietta, Ga. $6,-,360. Spare parts for C-5A aircraft. achment 81, San Antonio Air Ma-iel Area, AFLC, Marietta, Ga. AF33 7)-15053.

:as Instruments, Inc., Austin, Tex. $22,-,000. Developing and producing four ments (two sets each for the Air Force Marine Corps) of photo interpretation ipment for evaluating aerial film. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0052.

29—Rand Corp., Santa Monica, Calif. $2,200,-000. Studies and research. Air Force Office of Scientific Research, Arlington, Va. F44620-67-C-0045.

30—Rohr Corp., Chula Vista, Calif. $2,633,-400. C-141 aircraft exhaust cone assemblies. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F04606-70-A-0067.

—Republic Electronic Industries, Inc., Melville, N.Y. $1,283,136. Design and fabrication of Tacan AN/ARM-135 airborne navigation equipment maintenance test set. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-1005.

—Elder-Oilfield Inc., Houston, Tex. $2,537,-555. Eight modular relocatable medical buildings. Merced, Calif., and Houston. Civil Engineering Center, Wright-Patterson AFB, Ohio. F33615-70-C-1606.

OFFSHORE

8—Canadian Commercial Corp., Ottawa, Ontario, Canada. $1,108,582. 300,900 steel helmets. R. J. Stampings Co., Ltd., St. Anne Des Plains, Quebec, Canada. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1506.

ESD Detachment Formed at Eglin AFB

The Air Force Systems Command's Electronic Systems Division (ESD), L. G. Hanscom Field, Mass., has established Detachment 14 at Eglin AFB, Fla. Formerly a field office, the detachment is commanded by Colonel John A. Trask.

Detachment 14 will initially participate in the testing of the Airborne Warning and Control System (AWACS). When the detachment becomes fully operational it will support all ESD programs under test at Eglin.

New System Detects Engine Fire, Overheat

An integrated computer system, which can detect fires and overheat in jet aircraft engines in one-tenth of a second, has been developed for the Air Force Aero Propulsion Laboratory, Wright-Patterson AFB, Ohio. The original computer detection system was designed by the laboratory; Delco Radio, Kokomo, Ind., designed and built the system.

Weighing less than four pounds, the advanced computer can handle 24 sensors (ultraviolet and infrared fire detectors) and continuous element overheat detectors. It can operate in any of 5 modes and will normally handle up to 12 types of sensors simultaneously, as required. The computer has all necessary electronics to process analog signals from any available group of fire or overheat detectors, and to determine whether a fire, overheat, or failure of the system has occurred.

The detection system will be flight tested this summer by the Air Force Systems Command's Aeronautical Systems Division (ASD). It is designed to be used on any type of jet aircraft, military or civilian.

Aero Propulsion Laboratory, in cooperation with ASD's Deputy for Engineering, will prepare specifications for the system so that it may be bought "off the shelf." Terry Trumble is the laboratory's project manager for the system.

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New Target Missile Sought by Army

A variable speed training target (VSTT) for air defense weapons and guided missiles has been approved for development by the Army. Requirements for the target system, which may eventually replace all subsonic guided missile systems now in the Army inventory, were prepared by the Army Combat Developments Command, Fort Belvoir, Va.

The system is to combine low cost, simplicity, reliability, and transportability. Performance-wise, the VSTT would be capable of simulating a subsonic airborne threat, in support of Redeye missile, 40mm and quad 50 gun, Vulcan, Chapparal, Hawk and Nike firings requiring live targets. It will provide worldwide training targets for air defense guns and missile systems in any geographic or environmental location from the arctic to the tropics.

Operationally, the VSTT is seen as being used in training missions requiring target missiles with variable speeds up to 500 knots, with a capability of being augmented with 115 pounds of ancillary equipment. This equipment could include infrared sources, radar echo augmentations, night lights and scoring devices, mounted either internally or externally. For over-the-water ranges, it would be equipped with a water recovery kit giving up to one-hour flotation capability.

In flight, the VSTT would perform at speeds from 250 to 500 knots without tow, and 250 to 400 knots with tow, operating at minimum altitudes. Altitude performance would range from 100 meters above the terrain to more than 12 kilometers.

The VSST is to be recoverable by means of a recovery parachute or other device, on command, or on loss of transmitter carrier tone or power.

Logistics Terms Glossary Available

An Air Force technical report, called "A Compendium of Authenticated Logistics Terms and Definitions," is available to industry. The book contains 8,300 definitions and 3,300 abbreviations compiled from 430 DOD sources.

Lieutenant Colonel Fred Gluck, USAF, Assistant Professor of Logistics Management at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio, compiled the glossary.

The compendium is available for $3 per hard copy and 65¢ per microfiche copy (Order No. AD 700 006) from the Commerce Department Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151. Orders to the Clearinghouse must be prepaid.

Microfiche copies of the glossary are available free to users registered with the Defense Document Center, Cameron Station, Alexandria, Va. 22314. Hard copies are $3.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1970 393-618/11

DEFENSE INDUSTRY BULLETIN

JULY 1970

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DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 7 July 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds is approved by the Director, Bureau of the Budget.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

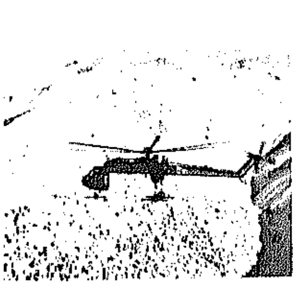
Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

IN THIS ISSUE

FEATURES

DEPARTMENTS



Snow covered Alaskan mountains profile a CH-54 Flying Crane helicopter as it logs test hours. The helicopter proved versatile, reliable and adaptable in the extremely cold climate. An article on the activities of the U.S. Army Arctic Test Center begins on page 20.

Weapon Systems Planning

James Bain Jr.
Lieutenant Colonel Edward Shabsin, USAF

The nationally important goal of acquiring effective and economical weapon systems is worthy of the best management concept available. For this reason, system/project management is used throughout the Defense Department to acquire costly and complex weapon systems. This management concept centralizes authority to make decisions together with expertise to perform two integrated system management functions, which we shall call *systems planning* and *programming-budgeting*.

Systems planning helps the system manager determine what system shall be acquired and used. It is product related and needs oriented. It translates the approved statement of need to a *system plan*, which continually defines and refines the technical design and logistical support of the system during the life cycle phases. In the conceptual phase, the best conceptual system is defined by a set of technical design and logistical support concepts. In the contract definition and development phases, the best system configuration is defined by a set of technical characteristic and support element parameters. Finally, in the production and operation phases, the best system modifications are defined to update technical characteristics and support elements of the operational system.

Programming-budgeting helps the system manager determine what organizational tasks shall be accomplished to develop, produce, deploy, operate, and support the approved system. It is operations related and resources oriented. It translates the approved system plan to a *master plan*, which continually defines and refines the schedule, cost, and scope of all work to be performed by supporting government organizations and defense contractors during the life cycle phases. The master plan is constrained by the available resources of the Five Year Defense Program (FYDP).

Both system and master plans must be continually controlled during the life cycle to respond to changing needs and resources. An effective system manager cannot blindly adhere to static and inflexible plans in an environment of uncertainty and change. Dynamically changing threats produce changes in the needs, producing changes in the system plan which may change the master plan. Correspondingly, changes in available resources change the master plan, which may change the system plan. Clearly, the system plan and master plan are interactive and inseparable as they undergo continuous refinement and change during the life cycle.

This article presents an *approach* to the systems planning function of weapon system/project management. Programming-budgeting will not be considered because there is more than ample literature on this function which uses concepts of network planning, critical path analysis, and exception reporting. In contrast, systems planning has been almost completely ignored.

Weapon systems planning can be described by what it does. It generates the information needed by the system manager to make logical system decisions, and to communicate the logic of his decisions to higher authority for conditional approvals of the system plan.

It can also be described by how it is accomplished. It uses a formal decision-making process, quantitative value criteria, analytical methods and tools, and interdisciplinary skills, under the guidance of the system manager.

A description of what is involved in weapon systems planning presents a more comprehensive view than a mere statement of its purpose. We shall, therefore, briefly examine system planning in terms of its:

- Formal decision-making process.
- Quantitative value criteria.
- Analytical methods and tools.
- Interdisciplinary skills.
- Planning-briefing-guidance cycle.

Formal Decision-Making Process

The keystone of good systems planning is a formal, deliberate, systematic decision-making process, illustrated in Figure 1 (page 2). The six steps of this procedure are elaborations of generalized decision making in any field. The usual steps of defining the problem, developing and analyzing solutions, and selecting the best, are expanded here to six steps, to describe in greater detail the process applied in weapon systems planning.

A brief explanation of the purpose of each step of this formal decision-making process may be helpful at this point:

- *Definition step* defines what oper-

Formal Decision-Making Process Used in Weapon Systems Planning

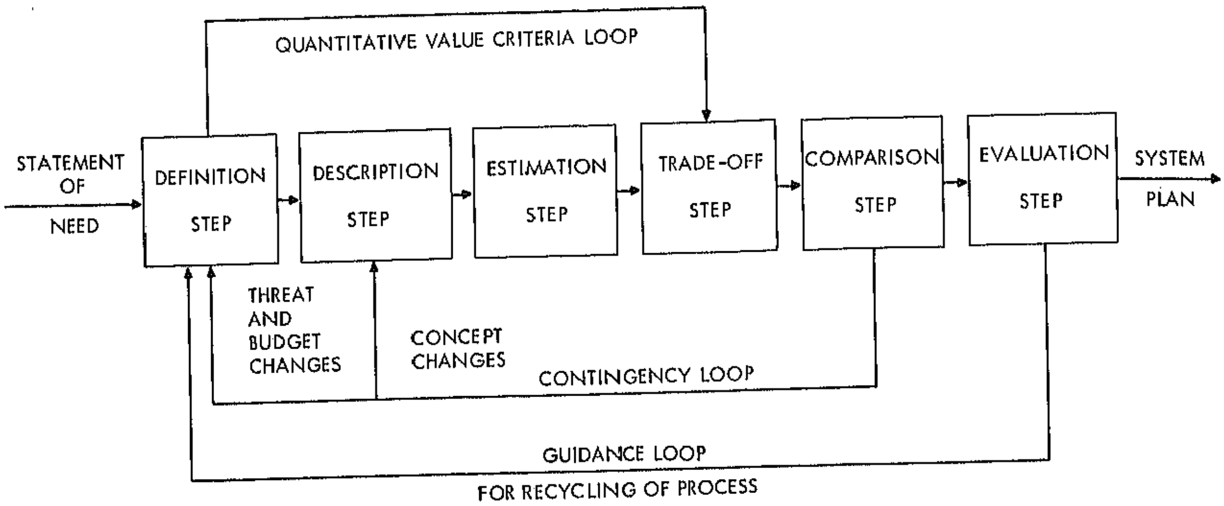


Figure 1.

ational characteristics will be needed by the system to perform specified missions against assumed threats; what life cycle cost can be afforded for acquisition and operation of a specified operational quantity of the system for assumed budgets; and what utility[1] value criteria will be used to compare the mission performance, life cycle cost, and operational schedule of alternative systems.

- *Description step* generates and describes conceptual systems which may satisfy the mission performance requirements. A system description includes its technical/support concepts and technical characteristic/support element measurements.
- *Estimation step* estimates the operational characteristics, life cycle cost, and operational schedule of all possible combinations of technical characteristic/support element measurements of each conceptual system.
- *Tradeoff step* optimizes the technical characteristic/support element measurements of each conceptual system based upon the utility value criteria.
- *Comparison step* compares the utility values of alternative systems for *each* change in technical/support concept, threat, and budget.
- *Evaluation step* provides the decision maker with the expected utility values and risks of the alternative systems among *all* assumed threat and budget contingencies. This information combined with the decision maker's judgment of whether or not the consequences are acceptable leads to a decision to either continue systems planning or select a system which is effective and economical enough to satisfy the requirements.

The primary advantage of this formal decision-making method is that it generates expected value and risk information needed to select the best system, and to justify the logic of that decision to higher authority. While intuition is, no doubt, inherent in the formal decision-making process, the complexity of modern day weapon systems exceeds the ability of a decision maker to intuitively make the right decision. The multiplicity of factors and their interreactions are beyond the comprehension of the intuitive mind. Further, information based solely on intuition is seldom subject to logical scrutiny and formal justification. Unless higher authority can be convinced by rationally acceptable information that a chosen system offers the most advantageous combination of value and risk, the system plan will not be approved. The penalty for not using a formal decision-making process is delay after delay of approvals, until the system is cancelled.

Another advantage of the formal decision-making process is that valuable executive time and effort can be saved by delegating the work of generating decision information to specialists. A weapon system manager never has all the expertise and time needed to generate information for total decision making; therefore, he must convert to procedure what he has done before by intuition. A specialist has particular expertise, and he can be given the time to perform the work called for by the procedure. Under the guidance of the weapon system manager, a team of specialists can pool their knowledge, judgment, and skills to help solve complex system problems. They can also use the powerful tools of mathematical analysis, information processing, and independent estimates to reduce uncertainty of numbers and assumptions.

While the weapon system manager does not have to do the work of specialists, it is essential that he fully understand the decision-making proc-

[1] *"Utility means usefulness, the satisfying of a need. A decision or an outcome has high utility when it satisfies the need as well as it can with available resources." J. Morley English, ed.,* Cost-Effectiveness, The Economic Evaluation of Engineered Systems, *p. 84.*

ess to be able to use the expertise of specialists. He must know the why, who, when, where, and what (but not necessarily the how) of the system decision-making process. He must know why it is important that it be used, and what specialists are needed to do what jobs. He must also know when and where analytical methods and tools should be used. Specialists are trained to know how to use those essential methods and tools. Simply, the formal decision-making method is a "harness" within which a system manager integrates the efforts of his specialists to generate the decision information he needs.

Quantitative Value Criteria

There are three quantitative value criteria used in the formal decision-making process. These are:

- *System effectiveness*—the *military value* of the improvement in mission performance achieved by a system alternative, at the time of its deployment against an assumed threat. It can be measured on a utility scale between 0 (the military value of the mission performance of the existing system), and 100 (the military value of the mission performance needed in an improved or new system, at the required time of deployment). An effectiveness measure of 80, for example, indicates a given system will achieve 80 percent of the performance improvement needed, but 20 percent additional improvement is still desired.
- *System economy*—the *budgetary value* of the incremental life cycle costs conserved by a system alternative at the time of its deployment, and for an assumed budget ceiling. It can be measured on a utility scale between 0 (the budgetary value of the inherited plus the incremental funds which is the ceiling that higher authority can afford to spend for an improved or new system), and 100 (the budgetary value of the funds inherited from the existing system at the time it is replaced). The future costs of operating and maintaining the existing system are inherited by the new system, when it replaces the old. These budget funds have already been allocated by *previous* decisions. Incremental costs are the additional future funds needed by the new system. These budget funds must be allocated by *future* decisions. Therefore, an economy measure of 85, for example, indicates a given system will conserve 85 percent of the maximum incremental life cycle funds that can be afforded.
- *System worth*—the *national value*, or the sum of the weighted effectiveness and economy, of a system alternative at the time of its deployment, and for an assumed combination of threat and budget. It is also measured on a utility scale between 0 and 100. The mathematical expression for system worth (WORTH) is:

$$\text{WORTH} = \text{wEFF} + (1-\text{w})\,\text{ECON}$$

where,

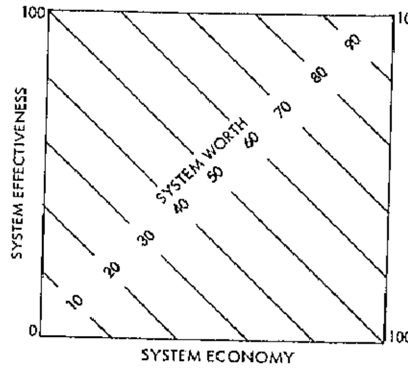
EFF = system effectiveness
ECON = system economy
w = relative importance of system effectiveness compared to system economy, *i.e.*, weighting factor.

The relationship between system effectiveness, economy, and worth is graphically illustrated in Figure 2. Figure 2a shows the relationship when the importance of system economy and system effectiveness are equal. Figure 2b shows the relationship when system economy is more important than system effectiveness, *i.e.*, in a period of austerity.

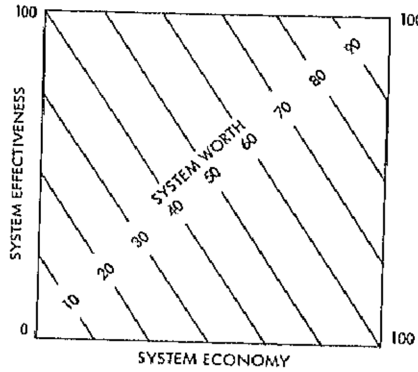
System worth is a very important compromise criterion. Usually a decision to select a system is a compromise between what performance is needed, and what cost can be afforded. Military users want a system with maximum effectiveness. A decision to select a system with either maximum effectiveness or maximum economy will seldom satisfy both the military and budgetary points of view. The criterion of system worth is, therefore, necessary to represent the national interest point of view. This compromise provides the maximum system effectiveness that can be afforded by the anticipated available dollars.

Quantitative value criteria of system effectiveness, economy, and worth are mandatory for the calculation of the military, budgetary, and national values, respectively. For any assumed threat, there is an effectiveness value of performance (or a military value) of each system alternative. For any assumed budget, there is an economy value of life cycle cost (or budgetary value) of each system alternative. For any assumed combination of threat and budget, there is a worth value (or a national value) of each system alternative. These quantitative values inform a weapon system manager of the expected values of system alternatives. He must then judge whether a system alternative is valuable enough to select and attempt to justify.

Quantitative value criteria are equally necessary for the calculation of the expected risk of system alternatives among all anticipated contingencies. Effectiveness and economy values of system alternatives will change as changes in future situations occur. It is logical to choose a system alternative with maximum value, contingent upon the occurrence of the most likely situations. But, if those situations do not occur, then the system alternative may have a lesser



2a EQUAL WEIGHTING OF PERFORMANCE AND COST
WORTH = .5EFF + .5ECON



2b COST WEIGHTED MORE IMPORTANT THAN PERFORMANCE
WORTH = .4EFF + .6ECON

Figure 2.

value in other situations. This introduces risk into system decision making. Risk is the loss of system value which results from predicting the wrong future situations or contingencies. It can be determined by calculating the difference between system values across all anticipated contingencies.

The formal decision-making process combined with the quantitative value criteria is often referred to as the "quantitative decision-making process." This means that both numbers and procedure are inseparable in system planning. Procedure without numbers prevents a weapon system manager from using specialists with their new and powerful analytical methods and tools. On the other hand, numbers without procedure lead to overemphasis upon analytical methods and tools. One becomes mesmerized by sophisticated mathematics, and is consumed by the cannibal appetite of their insistent promoters.

A weapon system manager must understand the quantitative value criteria which are used to inform him of the expected values and risks of each course of action. He must also be able to use these numbers to convince higher authority of the rationality of his system decisions to obtain the conditional decision for engineering development, ratification of that conditional decision, and approval for production of the system.

Analytical Methods and Tools

The quantitative decision-making process requires the use of modern analytical methods and tools. These methods and tools, and their purposes, are:

Utility theory. This method is used to quantify the *relative* importance of performance, cost, and schedule requirements in assumed situations. Quantified value judgments are used to calculate the utility value criteria of system effectiveness, economy, and worth. Remember that performance, cost, and schedule measures themselves reveal nothing about their relative value. It is a simple truism that one can know the performance, cost, and schedule of everything, but the value of nothing.

The effectiveness of mission performance must be judged by military experts who have to use that performance against a future threat. The weight of effectiveness of performance compared to the economy of cost must be judged by executives who will approve both the system to be acquired and the resources to acquire and operate it.

In the past, performance, cost, and schedule have not been translated to commensurate scales; therefore, they could not be related to obtain meaningful value criteria. The use of utility values for performance and cost, however, provides the means whereby they can be mathematically combined into system effectiveness and economy criteria, which are commensurable and, more important, which consider the effects of schedule or time upon the effectiveness and economy values.

Discounting. This technique is used to determine the effects of time upon system effectiveness, economy, and cost values. Effectiveness and economy are discounted to the required time of deployment, *i.e.*, operational readiness date. A delay in the deployment schedule of a given system will reduce its effectiveness by an obsolescence rate. If a new system, intended to replace an existing system, is delayed in deployment, its economy will be reduced by the loss of those funds needed to continue the operation and support of the existing system beyond its intended life.

Life cycle cost is discounted to present dollar value by a discount rate. DOD Directive 7041.3 describes cost discounting and prescribes a discount rate of 10 percent.

Mathematical models. This tool is used to represent criteria, systems, and tradeoffs. There are nine different mathematical models which are developed in the quantitative decision-making process. These models can be classified by what they represent as tabulated in Figure 3. Criteria models of effectiveness, economy, and worth are used to estimate the value of the performance, cost, and schedule of a given system in assumed threat and budget contingencies. System models of design, support, and cost are used to estimate the performance, cost, and schedule of alternative systems. Finally, tradeoff models are used to estimate the optimum technical characteristics and support elements of each alternative system.

Simple sketches are among the essential tools for developing mathematical models. For example, a cost analyst can explain and illustrate what his cost model does by using a three dimensional sketch shown in Figure 4. The cost model estimates the life cycle cost of all feasible combinations of technical characteristics and support elements between the limits of the most economical (cheapest) and maximum attainable configuration and support. It first estimates the base cost of the most economical configuration and support. Next, it estimates the cost increase for the improved configuration. Finally, it estimates the cost increase for the improved support. The cost model sums the base cost and additional cost of

Mathematical Models Developed and Used in the Quantitative Decision-Making Process

Model Representations

System Elements	Criteria	System	Tradeoffs
System Output	System Effectiveness Model	Design Model Support Model	Maximum Effectiveness Tradeoff Model
System Input	System Economy Model	Cost Model	Maximum Economy Tradeoff Model
System Output/Input	System Worth Model	—	Maximum Worth Tradeoff Model

Figure 3.

improvements. Pictures, like the example, help one visualize what a complex mathematical model is calculating.

Computers. This information processing tool calculates and merges mathematical models with speed and accuracy. It is emphasized that computers do not make any decisions; they only expedite calculations which could not possibly be accomplished manually in the planning time available.

Payoff Matrices. Matrices can replace "cost effectiveness curves" which have been traditionally used in cost effectiveness studies. A matrix provides a convenient table which can show the values of all alternatives across all assumed contingencies. Further, a matrix can be evaluated by the mathematical expectation concept. A cost effectiveness curve can neither show the values of all alternatives across all contingencies, nor be evaluated to provide expected values and risks of alternatives.

Statistical Decision Theory. This tool reduces large size payoff matrices to a single column ranking of system alternatives, based upon a mathematical expectation or gaming criterion. It also eliminates undesirable system alternatives by rules of dominance.

Example Sketch Used To Explain What the Cost Model Does in Relationship with the Design and Support Models

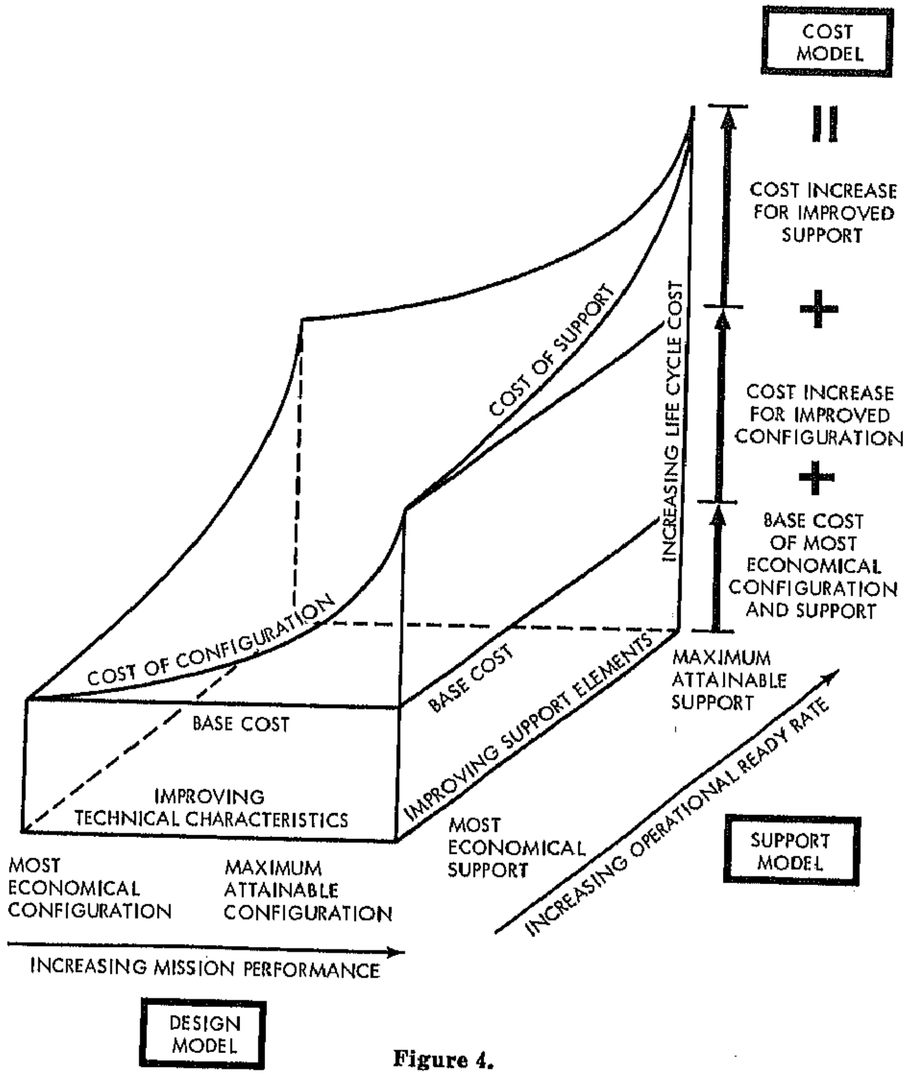


Figure 4.

Analytical Analyses

The quantitative decision-making process also involves synthesis and analysis which are performed in *specific* steps of the process. The analyses performed in each step and their purposes are briefly described at this point.

Definition. Three types of analyses are involved in the definition step. *Mission analysis* defines and relates the operational characteristic measurements that will be needed by a system to perform a specified mission. *Threat analysis* defines the effectiveness limits of each operational characteristic for each assumed threat scenario. *Economic analysis* defines the economy limits of the life cycle costs for each assumed budget ceiling.

Description. In describing a system, *synthesis* combines technical and support concepts to describe a base, or initial, conceptual system which may satisfy the performance requirement. *Innovation* changes the technical and support concepts to describe a change which may improve the performance, cost, and schedule of the base conceptual system.

Estimation. In the estimation step, *design analysis* develops a design model for each conceptual system to estimate its operational characteristic measurements for combinations of technical characteristic measurements, assuming that the logistical support is performed under ideal conditions. *Support analysis* develops a support model for conceptual system to estimate the operational ready rate for combinations of support element measurements, given the inherent availability and dependability of the system. *Cost analysis* develops a cost model to estimate the investment and operation cost, discounted to present value, for combinations of technical characteristics and support elements, given the prescribed operational quantity of systems and their operational lifetime. *Sensitivity analysis* estimates the relative effects of statistical and decision uncertainty of inputs upon the performance and cost outputs of the design, support, and cost models.

Tradeoff. In the tradeoff step of the quantitative decision-making process, *economy tradeoff analysis* optim-

Planning-Briefing-Guidance Cycle with Typical Cycle Schedule

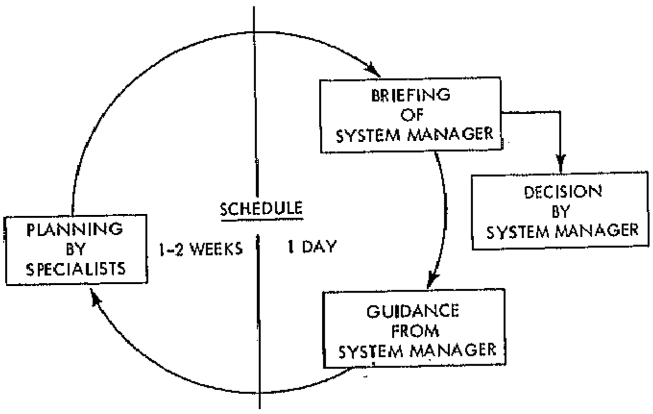


Figure 5.

izes the technical characteristic and support element measurements of each system, based upon the criterion of maximum system economy. *Effectiveness tradeoff analysis* optimizes the technical characteristic and support element measurements of each system based upon the criterion of maximum system effectiveness. *Worth tradeoff analysis* optimizes the technical characteristic and support element measurements, based upon the criterion of maximum system worth.

Comparison. In this step of the process, *concept contingency analysis* develops the worth matrix for each system to compare the changes in worth of innovations in its technical and support concepts. *Threat contingency analysis* develops the effectiveness matrix for each system to compare the changes in effectiveness for changes in threats. *Budget contingency analysis* develops the economy matrix for each system to compare changes in economy for changes in budgets.

Evaluation. Finally, in the evaluation step, *statistical analysis* ranks system alternatives by expected effectiveness and economy values. *Risk analysis* ranks system alternatives by expected effectiveness and economy risks.

A weapon system manager must know what, and where, analytical methods and tools are used in the steps of the quantitative decision-making process. He must also know the purpose of each method or tool to ensure that specialists contribute only that which is needed, when and where it is needed.

Interdisciplinary Skills

The combined effects of the increasing use of modern analytical methods for solving problems, and the proliferation of specialists in their use, has created the need for interdisciplinary skills to perform the steps of the quantitative decision-making process. No single individual has all the expertise required to perform these steps. With both the depth and breadth of knowledge continually expanding, individuals *must* specialize because they can absorb only so much knowledge in a lifetime.

A weapon systems planning team must, at least, consist of individuals for the following functional disciplines: military, systems engineering, financial analysis, cost analysis, statistics, and computer sciences. The team can be augmented in both depth and breadth, as necessary, by supporting government organization and defense contractor expertise.

The centralized interdisciplinary team approach is why system/project management has had a greater success in responding to complexity than any other management concept. System management brings unlike specialists together, to work together in managing complex and costly weapon systems. This team approach has also created the need for system managers who can coordinate and integrate specialists without necessarily being able to perform the jobs of specialists. One can, for example, manage a hospital and hire a brain surgeon without becoming one.

Planning-Briefing-Guidance

A planning-briefing-guidance cycle (Figure 5) is mandatory between the system manager and his systems planning team. The team, recycling through the contingency loop of the quantitative decision-making process, generates expected value and risk information for the system alternatives. After a period of one to two weeks of this planning activity, they stop to brief the system manager on the information generated to date. Based upon this interim value and risk information, the system manager provides guidance for their next period of planning. This recycling continues until a decision is made. It then begins all over again to generate information for the next system decision.

Time and resources are often limiting factors in this planning-briefing-

James Bain Jr. teaches systems planning subjects in the senior resident course at the Defense Weapon Systems Management Center, Wright-Patterson AFB, Ohio. He is a member of Ohio State University which provides faculty support to the center. Mr. Bain is a graduate of the Massachusetts Institute of Technology and holds a MBA degree from Syracuse University.

guidance cycle. These constraints may compress, *but must not eliminate*, any steps of the quantitative decision-making process. If compression is necessary, then the process must concentrate on the most important operational characteristics, the most sensitive inputs to the design, support, and cost models, and the most likely threat and budget contingencies.

There are two major objectives in the planning-briefing-guidance cycle:

- It keeps the systems planning team oriented towards the objective of generating the information needed for system decisions. Without continuous guidance from the system manager, a specialist tends to direct his attention and efforts toward pursuit of his own individual interests and goals. If cooperation in combining knowledge, judgment, and skills fail, then the systems planning team is totally ineffective.
- It makes a system manager more and more knowledgeable about his system. Periodic briefings help him to get answers to questions anticipated during the formal justification to higher authority. Experience has shown that the system managers who have been most successful are those who have done their systems planning "homework" so as to be able to answer multifaceted questions asked by higher authority. If a system manager must continually return to seek answers to questions, then he loses his credibility, and he experiences serious delays in approval of the system plan.

Lieutenant Colonel Edward Shabsin, USAF, is a faculty member of the Defense Weapon Systems Management Center, Wright-Patterson AFB, Ohio. He teaches project management subjects in the senior resident course. Colonel Shabsin is a graduate of the University of Illinois and holds a masters degree in business administration from Indiana University.

Summary

The system management concept centralizes a system decision maker together with an interdisciplinary team in order to be more responsive to urgency than does any other management concept. This centralization accelerates the generation of information by specialists, the selection of a system plan by the system manager, and the approval of the system plan by higher authority.

In today's highly competitive environment for the allocation of national resources, no system can be approved without credible information about its expected value and risk. The quantitative decision-making process is what generates this expected value and risk information. System managers delegate the work of generating this information to an interdisciplinary planning team. These specialists apply their combined knowledge, experience, and skills to continually define and refine a system plan; they can also apply powerful analytical methods and information processing tools to reduce the uncertainty of estimates and assumptions. Under the guidance of the system manager, they continually generate information which helps him to be the most knowledgeable man in the world with respect to his system. This informed knowledge is the basis for logical system decisions, and the instrument for communicating the logic of those decisions to higher authority for approval.

It can be reasonably assumed that system management can be more successful if the system manager insists upon using a formal quantitative decision-making approach to generate expected value and risk information. The penalty for not using it may be frustration and delay of the approval of the system plan. The only penalty for using the formal quantitative decision-making process is that one has to learn it. One can learn by personal experience, or from the experience of others. This article is a brief summary of what has been learned about systems planning from the experience of practitioners in military system/project management.

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RFPs for A-X Plane Issued by Air Force

Requests for proposals (RFPs) for the competitive prototype development phase of the A-X specialized close air support aircraft have been issued to 12 companies by the Air Force.

The proposals are due in early August, with evaluation to be completed within approximately 75 days of receipt. Contracts with two companies for the competitive development phase, lasting approximately 26 months, would then follow.

RFPs were issued to: Beech Aircraft Corp., Wichita, Kan.; The Boeing Co., Seattle, Wash.; Fairchild Hiller Corp., Germantown, Md.; Grumman Aerospace Corp., Bethpage, N.Y.; LTV Aerospace, Inc., Dallas, Tex.; North American Rockwell Corp., El Segundo, Calif.; Textron Inc., Providence, R.I.; Cessna Aircraft Co., Wichita, Kan.; General Dynamics Corp., New York, N.Y.; Lockheed Aircraft Corp., Burbank, Calif.; McDonnell Douglas Corp., St. Louis, Mo.; and Northrop Corp., Beverly Hills, Calif.

Management of the program is provided by the Air Force Systems Command's A-X Systems Program Office, Aeronautical Systems Division, Wright-Patterson AFB, Ohio.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

The President has designated **Adm. Thomas H. Moorer**, USN, former Chief of Naval Operations, the Chairman of the Joint Chiefs of Staff. Adm. Moorer replaces **Gen. Earle G. Wheeler**, USA, who retires on July 2.

VAdm. Eli T. Reich, USN, former Dep. Comptroller of the Navy, has been assigned to the position of Dep. Asst. Secretary of Defense, Materiel, Office of the Asst. Secretary of Defense (Installations & Logistics).

RAdm. William R. Flanagan, USN, is now Dir., East Asia and Pacific Region Office, in the Office of the Asst. Secretary of Defense (International Security Affairs).

Brig. Gen. George H. Sylvester, USAF, has been designated Asst. Dir. (Operational Test and Evaluation) in the Office of the Dir., Defense Research & Engineering.

Donald R. Cotter, previously Dir. of Systems Planning, Sandia Laboratories, Albuquerque, N. M., is the new Dir., Overseas Defense Research Office (Project Agile), Advanced Research Projects Agency, Office of the Dir., Defense Research & Engineering. He replaces **Seymour J. Deitchman**, who has returned to the Institute for Defense Analysis.

Effective July 20, **Maj. Gen. Robert H. McCutcheon**, USAF, will become Dep. Dir. for Contract Administration Services, Defense Supply Agency. He succeeds **RAdm. Joseph L. Howard**, USN, whose new assignment is Commanding Officer, Naval Supply Center, Charleston, S.C.

Maj. Gen. Kenneth C. Dempster, USAF, is scheduled to assume the post of Asst. Dir., Plans, Programs & Systems, Defense Supply Agency, on July 15.

The new commander of the Defense Supply Agency's Defense Construction Supply Center, Columbus, Ohio, is **RAdm. Grover C. Heffner, USN.**

Other new assignments within the Defense Supply Agency include: **Capt. Jerome A. Rehberg**, USN, Dep. Commander, Defense Fuel Supply Center, Cameron Station, Alexandria, Va.; **Capt. Edward E. Renfro III**, USN, Commander, Defense Contract Administration Services Region, Chicago; and **Lt. Col. Harold W. Edwards**, USA, Chief, Defense Contract Administration Services Office, Wichita, Kan.

DEPARTMENT OF THE NAVY

Adm. Elmo R. Zumwalt Jr. has been designated Chief of Naval Operations, replacing **Adm. Thomas H. Moorer** who has become the new Chairman, Joint Chiefs of Staff. Replacing Adm. Zumwalt as Commander, Naval Forces Vietnam and Chief, Naval Advisory Group, U.S. Military Assistance Command, Vietnam, is **VAdm. Jerome H. King Jr.**

Adm. I. J. Galatin, Chief of Naval Materiel, retired on July 1. His replacement had not been announced at press time.

RAdm. Philip A. Beshany has been named Asst. Dep. Chief of Naval Operations (Fleet Operations & Readiness). Also, **RAdm. James B. Osburn** has assumed the position of Asst. Chief of Naval Operations (Safety).

Other new assignments in the Office of the Chief of Naval Operations are: **RAdm. William H. House**, Dir., Strike Warfare Div. and Nuclear Attack Carrier Program Coordinator; **RAdm. Lester E. Hubbell**, Dir., Antisubmarine Warfare and Ocean Surveillance Div.; **RAdm. Frank H. Price Jr.**, Dir., Ship Characteristics Div. and Chairman, Ship Characteristics Board; **RAdm. Donald C. Davis**, Dir., Aviation Programs Div.; and **RAdm. Robert B. Baldwin**, Dir., Aviation Plans & Requirements Div.

RAdm. John M. Barrett has been designated Dep. Chief of Naval Material (Programs & Financial Management).

RAdm. William T. Rapp has been named Dep. Commander, Naval Ship Systems Command for Plans, Programs & Financial Management (Comptroller), Washington, D.C.

New Commanding Officer, Naval Supply Center, Norfolk, Va., is **RAdm. Elton W. Sutherling.**

DEPARTMENT OF THE AIR FORCE

Gen. George S. Brown, Dep. Commander for Air Operations, Military Assistance Command, Vietnam, and Commander, 7th Air Force, Pacific Air Force, has been designated to become Commander, Air Force Systems Command, Washington, D.C., effective Sept. 1. He will succeed **Gen. James Ferguson** who is scheduled to retire on that date. **Gen. (selectee) Lucius D. Clay Jr.** has been named to assume Gen. Brown's position in Vietnam.

Lt. Gen. Austin J. Russell will become Asst. Vice Chief of Staff of the Air Force on Aug. 1. He will replace **Lt. Gen. John W. Carpenter III** who is retiring.

Lt. Gen. (selectee) James T. Stewart has been designated Commander, Aeronautical Systems Div., AFSC, Wright-Patterson, Ohio. The command has been upgraded because of increased scope of activity and responsibility. Gen. Stewart replaced **Maj. Gen. Lee V. Gossick** who, in turn, assumed Gen. Stewart's former position as Dep. Chief of Staff, Systems, Hq., Air Force Systems Command.

Maj. Gen. David V. Miller has become Dir. of Development & Acquisition, Office of Dep. Chief of Staff, Research & Development, Hq., USAF. He replaced **Maj. Gen. Thomas S. Jeffrey Jr.** who retired.

Maj. Gen. Sherman F. Martin will assume the position of Asst. Dep. Chief of Staff (Program & Resources), Hq., USAF, on Aug. 1. He

(Continued on page 12)

Security in Time-Shared ADP Environment

Thomas J. O'Brien

It is no secret that security, like many other disciplines in the modern business world, has not kept pace with the rapid technological developments in automatic data processing (ADP). Need for security guidance and security rules to ensure that information in the ADP environment is properly safeguarded is quite apparent to security people of both Government and industry. In recognition of this need, the Office of Industrial Security, in the Defense Supply Agency's Contract Administration Services (DCAS), has mounted an intensive effort to fill this guidance gap. The purpose of this article is to tell you what we have done, what we are doing, and what we contemplate.

ADP presents some unique security problems. Its capacity for handling huge volumes of data and its incomprehensible speed are the keystones of this security problem. When an espionage agent obtains possession of a Secret document, it is a fairly time-consuming process to photograph each page. On the other hand, surreptitious entry to an ADP system can result in a compromise of a great volume of classified information in a timespan that is measured in micro-, milli-, or nanoseconds.

At the outset, it is important to establish that machine language does not render information secure. If classified data is to be electrically transmitted over lines outside a controlled area to or from a computer, it must be encrypted in the same manner as teletype, voice, or other communications. Communication between computers, although not readily understandable, is not secure from a standpoint of safeguarding of classified information.

Identification of Hazards

As a first step in providing security guidance applicable to the ADP environment, it is necessary to identify the hazards. Although our list may not be all-inclusive, it is a significant first step in determining the security weaknesses of ADP. We have identified these security hazards.

Rapid development in machine sophistication, and the paralleling increase in the cost of such equipment, makes *time sharing* one of the most significant and economically desirable elements of ADP. Systems are currently being developed whereby a number of users, by means of remote terminals in their own offices, can avail themselves of the advantages of ADP without investing in their own systems.

Thus far, the state of the art of system design does not enable us to ensure that data entered into the system by one user cannot be accessed by another user. This is the heart of the problem. There are some software and hardware techniques which give a degree of security in this connection but, to date, none provide the degree of security necessary for safeguarding of classified information.

This problem has to be solved by engineers and scientists rather than by the security professional. Therefore, the matter was referred to the Director of Defense Research and Engineering who, in turn, established a study project within the Advanced Research Project Agency (ARPA). The purpose of the ARPA study project is to develop hardware and software criteria, and an appropriate inspection capability which would result in a secure time-shared system.

Pending development of a secure time-shared system, Change 2 to the Industrial Security Manual (ISM) for Safeguarding Classified Information (Attachment to DD Form 441) prohibits the use of classified information in a time-shared system. It is important to point out that a single contractor can use multi-programming or multi-processing techniques within his own facility, but different contractors cannot share an ADP system on a classified information basis.

A second hazard in the ADP envi-

Thomas J. O'Brien is Chief, Programs and Systems Division, Office of Industrial Security, Contract Administration Services of the Defense Supply Agency. Before joining the Defense Supply Agency, he served with the Office of Naval Intelligence in positions of increasing responsibility. Mr. O'Brien holds a B.S. degree in business administration from the Georgetown University School of Foreign Service, and a J.D. degree from Georgetown University School of Law.

ronment concerns *transmission*. This problem is not peculiar to ADP. The ISM provides that telephone or other electrical transmission can only be used by the contractor if a secure electrical transmission system is approved by the DOD contracting officer. This, of course, requires a cryptographic system. Such systems, adaptable to ADP, are available within the state of the art, but their supply is very limited and, in most instances, just not available. The contracting user agency of DOD can provide for a secure system where the highest priority can be established. Even in these cases, a lead time of 18 months or more is necessary.

ADP represents a unique *personnel security* problem because it is possible for individuals to gain access to information in the system without physical presence. The best example of this is the programmer. The programmer, who designs an unclassified program which is run simultaneously with a classified program, can gain access to the classified program. Therefore, it is necessary in designing a secure system to ensure that all programmers possess the appropriate security clearances, or that programs written by uncleared programmers do not run simultaneously with classified programs.

Maintenance personnel in ADP present a security problem. A maintenance man having access to the system can easily circumvent its built-in security features.

Another hazard, also unique to the ADP field, is called *accidental access*. This occurs in a freakish situation when data in one program unexplainably appears in the output of another program. This is called "bomb out" when a great deal of data from one program unexplainably appears in another. It is called "drift" when only some of the data finds its way from one program to another. In any event, it is a problem we must be aware of and guard against. Some computer people have told us that, theoretically, with program bounds and other software techniques this should not happen. However, the best evidence available to date indicates that it does.

Physical security is a problem area which presents special challenges in the ADP field. When classified material is "in process," or "on line," it is clear that the system must be controlled by means of area controls. The problem does not stop there. If access to an ADP system is not controlled, even during periods when classified data is not in process or on line, uncleared personnel having access to the system can neutralize the security measures built into the system. Therefore, a closed area should be established for an ADP system on which classified data is processed.

Interim Actions

With these hazards in mind, we have developed some interim guidance and standards by which an ADP system can be analyzed. It is emphasized that ADP security policy is still in the "research and development" stage. Guidance set forth herein must be considered as interim in nature at this time.

We have found that, as a general rule, ADP systems fall in one of four configurations.

Self-Contained: Exclusive Use. This is when the entire ADP system is within a controlled area and there is physical disconnect of all remote terminals whenever classified data is in process or on line (Figure 1). By establishing a "controlled computer area," we ensure that only cleared personnel have physical access to this system. This prevents access to uncleared maintenance personnel who might intentionally circumvent security elements built into the system.

It is also necessary to establish a means for dealing with the problem of program access without physical presence. The best solution would be to clear all programmers. A less desirable system would be to ensure that programs, written by uncleared programmers, are not processed simultaneously with classified programs.

ADP CONFIGURATIONS

SELF CONTAINED: EXCLUSIVE USE

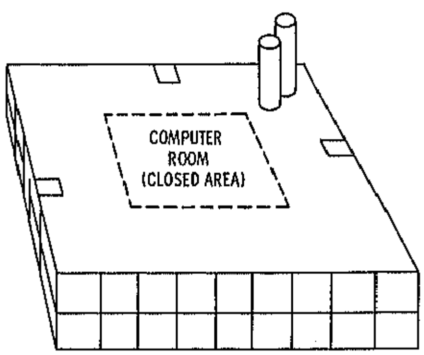
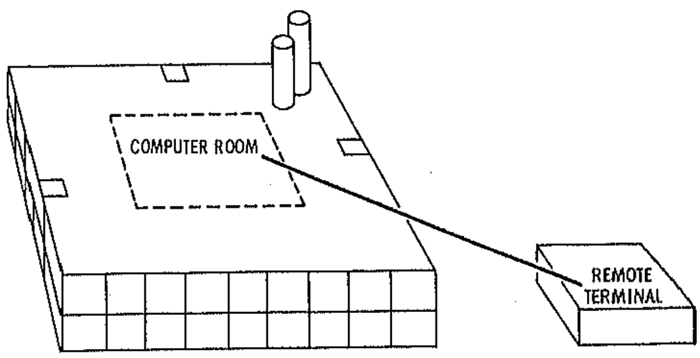


Figure 1.

INTERFACILITY: EXCLUSIVE USE



CRYPTO SYSTEM REQUIRED

Figure 2.

It is extremely important in the design of exclusive use systems to carefully consider all security problems, and then design a security system promulgated by means of a Standard Practice Procedure (SPP) or an appendix thereto. This SPP should make necessary provision to ensure that any system modifications are first coordinated with the security officer. He must determine that the modification does not invalidate the security integrity of the system. The SPP must require that programs be written with specific instructions to clear the system of all residual classified information at the completion of classified runs. Moreover, a security system established in an SPP will assist the contractor in self-inspection and the cognizant security office in its recurring inspections.

Interfacility: Exclusive Use. The second major configuration, which we encounter, is a contractor who has established his own ADP system with remote terminals outside his facility at his own branch offices (Figure 2). In other words, access to the system is limited only to employees of the contractor. The only unique problem here is the transmission problem. Here the policy is clear. The contracting officer can approve a cryptographic system. In the absence of approved cryptographic systems, classified information cannot be put into the computer unless the remote terminals are physically disconnected.

Intra-facility: Exclusive Use. This is the ADP system totally within the contractor's facility or complex (Figure 3). It is designed with remote channels located at various points *within* the facility, but remote from the computer room. The fundamental problem here is the security of the wire that connects the remote terminals and the computer. In essence, this wire is like a classified document, *e.g.*, classified material is readily obtainable by anyone who has access to the wire. The best method to establish security in this kind of condition is the use of cryptographic equipment. As previously said, availability of this equipment is severely limited. However, there is an alternative. It is possible to establish an "in-depth physical security system" to protect transmission lines located within the facility. In each case, it is necessary for the cognizant security office to approve the system.

This in-depth physical security system will normally consist of several physical security factors which, taken together, give the degree of security needed. Some of the factors or security elements which might be built into such a system are:

- Physical security of the perimeter of the facility complex—the same concept envisioned by Footnote 9, paragraph 14, ISM.
- Hardened or buried cables.
- Surveillance of cables. This can be established in several ways, either alone or in combination.
- Physical security of repeater stations or other terminals within a facility. This would normally be accomplished by area controls, strong rooms, or similar physical security systems.

To assure necessary surveillance of cables, periodic guard patrols can be established. The guard on patrol must be fully knowledgeable of where the cable is and what it is, so that he would immediately detect any unauthorized personnel attempting access to the cable. Such a security system is strengthened by having cables, carrying classified information, run in plain sight of corridors rather than hidden under false ceilings. A second method of surveillance would be a pressurized cable with a monitoring system. Guards could be dispatched to any point of the cable where pressure is broken. Another element in this security chain may well be monitored idle code transmission. This method would enable a monitor to detect any unauthorized probing or attaching onto the line. Still another surveillance method would be monitoring by closed circuit television, established in combination with a guard system.

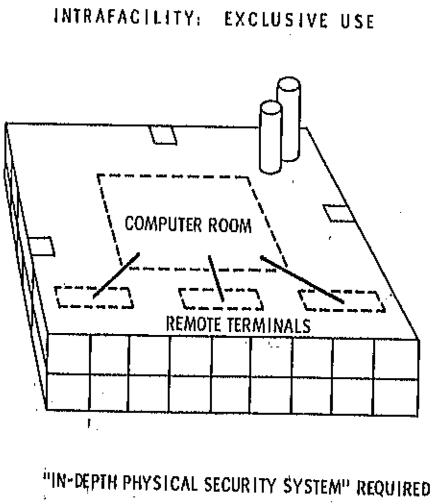


Figure 3.

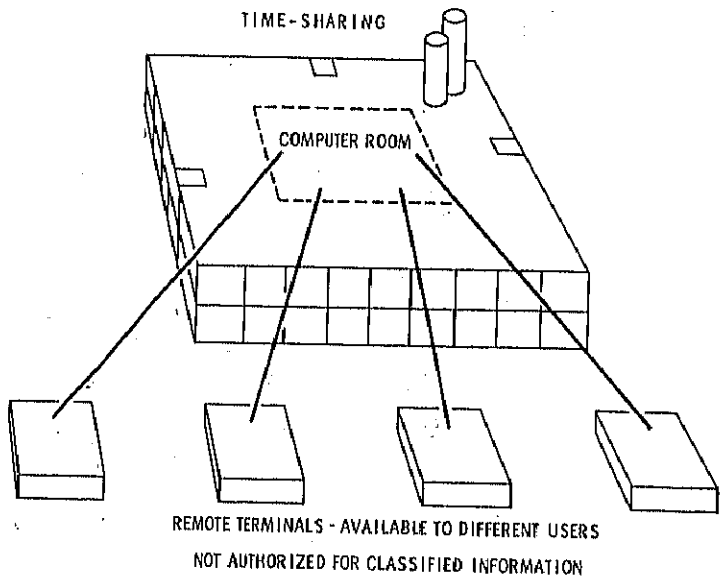


Figure 4.

Time Sharing. As discussed before, time sharing would involve the use of a single computer by more than one user (Figure 4). The policy here is clear—the ISM prohibits classified information in such a system. Let me point out again that we view this as interim policy. When the study now underway develops the necessary guidance and criteria, it is envisioned that time sharing under specified conditions will be authorized.

Regardless of the configurations of the ADP system, it is strongly suggested that every contractor utilizing ADP for classified data should have a security official assigned to the ADP operation. This security specialist should be thoroughly conversant with the ADP system, thereby enabling him to assess the security consequences of any proposed system changes or modifications. He would be responsible for monitoring the security aspects of the operation, and would be available for consultation on any security problems or questions.

ADP Subcontracting

Generally, the ADP subcontracting security question can be broken into two situations. First, there is the normal contractor-subcontractor relationship. When a prime contractor awards a subcontract which involves the use of ADP, the normal provisions of the ISM applicable to subcontracting apply.

The second situation is the use of service centers, service bureaus, etc. This involves a contractor using someone else's computer in a location other than his own plant to process a classified program. Change 2 to the ISM establishes the conditions under which this type of operation is permissible.

Basically, the requirements are that the computer be located in a cleared facility. Secondly, the user must obtain the exclusive use of the equipment while the classified program is being processed. A classified program cannot be processed if program or data, belonging to another user, is in process or on line. An operator employed by the service bureau may be used providing, of course, he is properly cleared. Third, the user must ensure the physical security of the system while his classified information is being processed. Finally, the user must obtain the prior approval of his cognizant security office.

The cognizant security office will ensure that the owner of the computer is, in fact, a cleared facility; that the user recognizes his responsibility to obtain exclusive use and provide for physical security. The cognizant security office will devote special attention and emphasis to ensure that the user has adequately provided for cleanup. In other words, it will ensure that appropriate steps will be taken to prevent any residue of classified material from remaining in the system.

In summary, I would like to briefly outline the action planned by the DCAS Office of Industrial Security to solve the ADP security problem.

First, Change 2 to the ISM provides some very important policy guidance. This is a big first step.

Second, in February 1969 cognizant security offices were provided specific guidance along the lines discussed in this article. In December 1969, this guidance was updated. Personnel of each cognizant security office are in a position to discuss your ADP problems and work with you to develop solutions to the ADP security problem.

Third, computer training has been provided for all representatives of the DCAS Office of Industrial Security. A pilot program, developed jointly by the DOD Computer Institute, the National Security Agency, the Defense Intelligence Agency, the Defense Communications Agency, as well as the Defense Supply Agency, was held in July 1969. This pilot program formed the basis for a security ADP training program held for all personnel of the office in the fall of 1969.

Fourth, and finally, we anticipate that an ADP Appendix to the ISM will be published in 1970.

It is recognized, of course, that there is still a long way to go. It is essential that standards and criteria be developed which will effectively safeguard classified information in a time-shared ADP environment. There is a need to increase the availability of cryptographic equipment with ADP interface.

The gulf in the ADP security state of the art has been significantly reduced. We are not there, but we are on the way.

About People

(Continued from page 8)

will replace **Maj. Gen. William B. Campbell** who is scheduled to become Chief, Army-Air Force Exchange Service, Dallas, Tex.

Brig. Gen. Edmund B. Edwards will replace **Brig. Gen. Richard L. Ault** as Dep. Dir. of Plans, Office of the Dep. Chief of Staff, Plans & Operations, Hq., USAF, on Aug. 1. Gen. Ault will retire.

Brig. Gen. (selectee) William R. Hayes has been assigned to Hq., USAF, as Asst. for Logistics Planning, Office of the Dep. Chief of Staff, Systems & Logistics.

New assignments within the Air Force Systems Command include: **Maj. Gen. Clifford J. Kronauer Jr.**, Dep. Chief of Staff, Operations, Hq., AFSC; **Brig. Gen. Robert A. Duffey**, Vice Commander, Space & Missile Systems Organization, Los Angeles, Calif.; **Maj. Gen. Louis L. Wilson, Jr.**, Commander, USAF Space & Missle Test Center, Vandenberg AFB, Calif.; **Brig. Gen. Harold F. Funsch**, Dep. Chief of Staff, Bioastronautics & Medicine, Hq., AFSC; **Brig. Gen. Herbert A. Lyon**, Asst. Dep. Chief of Staff, Systems, Hq., AFSC, with additional duty as Asst. for Southeast Asia; and **Brig. Gen. (selectee), Kenneth R. Chapman**, Dep. Chief of Staff, Development Plans, Hq., AFSC.

Maj. Gen. (selectee) Richard M. Hoban, has assumed command of the Air Force Logistics Command's Ogden Air Materiel Area, Hill AFB, Utah. His replacement as Vice Commander, San Antonio Air Materiel Area, Kelly AFB, Tex., is **Brig. Gen. (selectee) George Rhodes**.

Other assignments within the Air Force Logistics Command are: **Brig. Gen. William C. Fullilove**, Vice Command, Sacramento Air Materiel Area, McClellan AFB, Calif.; and **Col. Jacob B. Pompan**, Dir. of Procurement and Production, Warner-Robins Air Materiel Area, Robins AFB, Ga.

CORRECTION

Order number for Logistics Terms Glossary referred to in item on back cover, June issue *Bulletin*, is AD 700 066.

Economic Analysis of Navy Investments

Dick L. Jackson

The Department of the Navy has long recognized the need for using analytical techniques in the acquisition of investments. Among analytical techniques used in the past are systems analyses, cost effectiveness studies, cost tradeoff studies, benefit/cost analyses, analyses of repair versus replacement, lease versus buy, etc. Such studies have been conducted under a variety of instructions and requirements to assist in making sound management decisions.

These techniques are now covered under the provisions of SECNAV Instruction 7000.14 on economic analysis.

The principal objective of the Department of the Navy in its implementation of economic analysis is to assure that:

- Economic analysis techniques are ısed when they will contribute to sound decisions.
- Economic analyses are of such ıuality that they assist the decision naker.
- Manpower is not dissipated on conomic analysis that is not productive.

arly Instruction

The Department of the Navy origially issued an instruction on ecoomic analysis April 19, 1967. This lavy instruction implemented the OD instruction of Dec. 19, 1966, hich placed emphasis on commercial 'pe investments where the costs and enefits were primary factors in the decision process. Results of these economic analyses were to be forwarded to the Navy Comptroller and, if approved, eventually to the Office of the Assistant Secretary of Defense (Comptroller) in support of budget and program change requests.

Since the FY 1969 budget, the first year covered by the original instruction, the Navy has prepared a large number of economic analyses covering shipyard modernization, replacement of machine tools at naval aircraft rework facilities, lease versus buy of automatic data processing equipment, and construction or modernization of other Navy facilities. Of these anlayses, 146 were forwarded to the Office of the Secretary of Defense in support of budgets.

These analyses had profitability indexes ranging from 1 to 79. In other words, the most cost efficient project would return $79 for each $1 invested. Although each of these projects would theoretically, over time, result in a net saving to the Defense Department, only projects in the area of shipyard modernization, machine tool replacement at naval aircraft rework facilities, and a small portion of military construction projects were funded in the President's budgets.

These results suggest that, in the decision process, fiscal constraints and urgent military requirements often supersede the best judgments based solely on economic analysis. No matter how high the payback ratio of a commercial type project, it has a limited chance of being funded unless it also satisfies an urgent military requirement. Often the decision maker will not or cannot trade current year dollars for paybacks tomorrow, because of the importance of obtaining performance or output today, or because of political or intangible considerations.

Revised DOD Instruction

In February 1969, the Office of the Secretary of Defense issued a revised and expanded instruction (DOD Instruction 7041.3, "Economic Analysis of Department of Defense Investments"). This instruction provides for standard terminology and consistent application of analytical tools in the decision-making process. The most significant change from the previous DOD instruction was the broadening of the scope to include:

- Proposed investments in new, improved, or expanded weapon systems, related military systems, or alternative force levels for such systems.
- Investment proposals in support of research projects to increase effectiveness and promote economy in military programs.

New Navy Instruction

On Jan. 30, 1970, the Secretary of the Navy issued SECNAVINST 7000.14, "Economic Analysis of the Department of the Navy Investments." The objectives of this instruction are to:

• Identify systematically the benefits and costs associated with resources requirements so that useful comparisons of alternative methods for accomplishing a task or mission can be made.

• Highlight the key variables and the assumptions on which investment decisions are based and allow evaluation of them.

• Evaluate alternative methods of financing investments.

• Compare the relative merits of various alternatives as an aid in selecting the best alternative.

The new SECNAV instruction places emphasis on eliminating redundancy in analyses by accepting, particularly in the area of research and development and the acquisition of major weapon systems, an analysis of alternatives considered in documents such as development concept papers, contract definition studies, cost effectiveness and force tradeoff studies. Where instructions currently exist covering these special areas of analyses, they are used. For example, concept formulation studies and contract definition studies for engineering and operations system development are to be conducted under the provision of SECNAV Instruction 3900.13A, "Initiation of Engineering and Operations Systems Development." This instruction requires analysis of alternative approaches. Although these instructions do not include discounting techniques, they do not rule out such techniques when they will contribute to accurate decisions.

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SECNAV Instruction 7000.14 provides that discounting techniques should be used when they contribute to sound decisions. Further, a rate other than 10 percent may also be used if it can be shown that the discount rate is a basic factor in arriving at a good decision. Accordingly, the analyst may find it desirable to test at rates higher and lower than 10 percent before arriving at a judgment.

The new Navy instruction also allows managerial flexibility in determining when an economic analysis effort will be productive. This is considered essential as each year the Navy funds thousands of investments, and for nearly every one of these investments there are a number of alternative considerations which might be the subjects of formal economic analysis. Most well executed economic analyses are time consuming and expensive. If the Navy were to undertake a formal economic analysis every time a decision was required, it could result in a prohibitive workload for existing staffs.

The instruction also stresses the importance of quality economic analysis. A poor economic analysis is worse than no analysis at all. An economic analysis, no matter how poor, tends to produce an aura of professionalism that may cloud judgment.

The key to good economic analysis is consideration of all significant alternatives and parameters, and that accurate costs and benefits be associated with each of these parameters. Probably the most important role of an economic analysis is that it causes management to identify and evaluate the parameters of all alternatives involved. The identification of all significant parameters must be followed by the collection of accurate data and the application of proper techniques, if a good economic analysis is to be achieved. Further, it is important to guard against the inclination of an overly zealous manager to overstate benefits and understate costs.

The Navy instruction provides for a permanent advisory board, consisting of a professional from each of the following offices:

• Office of the Navy Comptroller—Chairman

• Office of the Chief of Naval Operations

• Headquarters, Marine Corps

• Office of Chief of Naval Material

• Office of Program Appraisal

Functions of this advisory board are to:

• Provide professional assistance to assure quality economic analysis.

• Interpret the meaning of the instruction and prepare supplemental guidance as may be required.

• Promote training and upgrading of personnel involved in preparing and reviewing economic analyses.

• Assure economic analysis effort when it will contribute to sound decisions.

• Assure that effort is not wasted on unproductive analyses.

Supplemental Instructions

Because of the varied nature of investments in the Navy, it will be necessary to issue supplemental guidance and instructions covering a number of areas. At this writing the Navy Facilities Engineering Command is preparing a detailed instruction covering military construction investments. This instruction will provide that an economic analysis be prepared for all investments where such an analysis would enhance evaluation of the project.

To distinguish between types of economic analyses, the Facilities Engineering Command instruction classifies economic analyses into primary and secondary categories. A *primary* economic analysis in the Facilities Engineering Command instruction is one employed to help determine whether an existing situation should change. For example, a determination as to the profitability of providing utility services at a pier and allowing the ship to shut down while berthed, versus operating equipment aboard ship to maintain utilities services. A

secondary economic analysis concerns itself with determining the most economical of several alternatives for satisfying a deficiency. An example would be "lease versus construct" analysis.

Potential Problems

Techniques and procedures for weapon systems. It appears that substantially greater effort should go into development of analytical techniques and procedures before economic analysis in the weapon systems area can be expected to achieve the desired objectives. For example, although extensive studies are conducted prior to making decisions on a new weapon system, it may be profitable to devote more attention to the costs of obtaining incremental performance at the frontier of technology. Often the next increment of performance is obtained only by crowding the development state of the art at inordinate costs.

Discounting. Some analysts are concerned about the use of a 10 percent discount rate for *all* economic analyses. Discounting serves two principle purposes in DOD:

- Comparison of investment of funds in the public sector with investment of funds in the private sector.
- Comparison of alternative investment cash flows within the Defense Department.

The latter use is most important to defense management. Concern about the 10 percent discount is based on three points. First, discounting often may not contribute appreciably to the decision-making process for many weapon systems and development studies when costs and benefits cannot be estimated with reasonable accuracy. Early estimates of research and development costs and/or benefits for new weapon systems often range substantially.

The second concern is that a discount rate, based on the average rate of return in the private sector, may not be the appropriate rate to apply to defense weapon systems. In the "real world," individual military investments are usually not funded in competition with the private sector. The military establishment is funded under a fiscal ceiling which rises and falls in relation to the conflict, or threat of conflict, existing at the time, and to other political pressures. Thus, in its own constrained world, DOD investments compete largely with each other.

As defense weapons are largely competing among themselves for funding from a single pot of money, there is logic for using a single discount rate for most defense investments, as provided in DOD Instruction 7041.3. Whatever the rate, its selection is a policy decision. However, this discount rate should be selected with care. High discount rates in general tend to favor continuing an old weapon system, rather than acquisition of a new weapon system, and vice versa. The rate of return may be the deciding factor in indicating which proposed investments are economically preferred.

Kenneth Boulding offered a little rhyme that highlights the influence of interest rates in connection with the water resource field:

> The long term interest rate determines any project's fate.
> At 2 percent the case is clear
> At 3, some sneaking doubts appear
> At 4, it draws its final breath,
> While 5 percent is certain death.

A third concern is about the applicability of a single discount rate for defense investments which are in competition with private sector investment. The single rate of 10 percent is based on the *average* economic opportunity rate of return on investments in the private sector. An average rate of return conceals wide variations. Therefore, economic analyses using an average rate of return may lead to biased comparisons.

This is most evident in those areas where the DOD investments are similar to investments in the private sector. Examples of such investments are the acquisition of office buildings, warehouses, and public housing. Alternatives in such cases are lease, lease-buy agreement, private construction, and government construction. In each of these areas, there is a private sector rate of return that is different from the average. Accordingly, it has been suggested that it may be more appropriate to use the rate of return of the specific part of the private sector, when analyzing these kinds of investments.

Risk and Uncertainty. The DOD instruction and SECNAV instruction provide that risk and uncertainty associated with investment proposals be set forth in narrative statements. No method has been established on how these narrative statements may be expressed as quantified data for analysis purposes. Obviously, in many studies these two factors may significantly affect the economic analysis.

Personnel. The quality of economic analyses is largely dependent on the staff personnel at the various management levels. As many economic analyses are complicated and require the application of special techniques and skills, many offices lack qualified personnel to perform well executed economic analyses. The Department of the Navy has partially offset this condition by establishing the permanent advisory board, which has as one of its responsibilities promotion of training and general upgrading of the analytical skill of Department of the Navy staffs.

Summary

Economic analysis is a valuable tool for identifying and evaluating the resource allocation consequences of investment proposals. However, it is important to caution that economic analyses only assist in the decision-making process. For example, a cost effectiveness comparison of procuring a new weapon system versus modernizing an old system may, because of the high initial capital outlay and a high discount rate, indicate the new weapon system is not the economical choice for the stated mission. However, the modernized weapon system may have no further growth potential, thus, leading to early obsolescence of the forces.

Military considerations must frequently override the economic results. In fact, it must be kept in mind that such analyses are only tools and are no guarantee that decisions will be better. Correct decision making depends on the quality of the analysis, the capability of the decision maker, future events, and luck.

Quality economic analysis will result in economic analysis decisions being based on better information. This will allow more effective use of the nation's resources.

Defense Research and the University

Dr. William J. Price

In the past three decades, an effective and important working relationship between the Defense Department and the university research community has come into existence. From this close partnership has developed a vigorous, sustained interchange of ideas, talented manpower, and mutually supportive activity.

For DOD it means direct and continuing access to scientific training, accomplishment and progress, accompanied by the personal attention to defense problems of some of the best scientific and technological talent in the country. Strong interactions have resulted between science and technology, with benefits both for the defense establishment, industry, and other sectors of the domestic economy.

For universities this means continuing support for basic and applied research as well as exploratory development, and a direct relationship between them and the technological needs of national defense. Increasingly, we see these needs straining the limits of current technology.

For these reasons the DOD-university research program, and that of the other Federal mission-oriented agencies, must be continually encouraged and strengthened. This does not preclude shifting of funding levels somewhat in times of austerity, but the basic relationship remains productive and must be effectively maintained.

World War II to Today

Defense Department research support programs began, in response to national needs during World War II, with the Office of Scientific Research and Development under Dr. Vannevar Bush. The Navy opened its Office of Naval Research in 1947, and the Army and the Air Force soon followed with corresponding offices. As the culmination of long planning, the National Science Foundation (NSF) came into being in 1951 for the support of university research and education in the sciences. NSF research programs were the first to support non-mission-oriented Federal basic research. Other agencies of the Government were also supporting university research along the lines of their agency responsibilities. These included the National Institutes of Health, the Office of Education, the Department of Agriculture (long-time research programs), and later the National Aeronautics and Space Administration. This development enabled the support of university research by a number of different sources of the Federal Government, a concept that has helped to ensure support for a wide variety of research of high quality.

Total Federal obligations for FY-1970 for research and development are estimated at about $16 billion. Of this amount, less than 10 percent, or $1.4 billion, goes to academic institutions for performance of research and development (Figure 1). Another $767 million goes to university-affiliated Federally Funded Research and Development Centers (FFRDC). About 16 percent of the total for universities comes from DOD, or about $223 million. DOD also provides about $150 million for its Federal Contract Research Centers (FCRC).

The DOD portion of support to university research and development about equals that of the National Science Foundation. For perspective, it must be realized that the figure for NSF represents all basic research—none for applied, and none for development, the costly item. NSF has another $200 million for science education, university development, national research centers, and related programs.

Over the past decade, total Federal support of university research and development has risen far faster than DOD's portion. DOD support has been fairly stable. The important point is that DOD's percentage decrease reflects the growing dependence of universities upon other sources of support. This fact indicates the urgency of making more funds for university research available through agencies such as the National Science Foundation. Undoubtedly this trend will continue and even accelerate as more funds for research become available. In 1952, the DOD share of total Federal university support was about half. In 1968, it was about 15 percent. However, most of the growth in Federal funds in recent years has been for fields outside the physical, mathematical, and engineering sciences. DOD still supports perhaps as much as one-half of the Federal total in these areas.

Current DOD Programs

In a letter to Senator Mike Mansfield in December 1969, Dr. John S. Foster Jr., Director of Defense Research and Engineering, described defense basic and applied research as

having three major functions: "to solve recognized technological problems which arise from both short and long range military operational requirements; to minimize the possibility of technological surprise; and, as an automatic byproduct of the first two functions, to contribute to the national technical base from which all agencies of the Government, including Defense, ultimately draw their scientific ideas and skilled manpower. . . ."

The DOD research program is in 13 scientific disciplines. Universities receive about 40 percent of these research funds, in-house efforts absorb about 40 percent, and all others account for about 20 percent. In addition, the research program includes Project Themis, conceived and directed to a large degree by the Directorate of Defense Research and Engineering, and set up to establish new centers of university expertise in selected areas related to defense problems.

DOD-University Mutual Interests

One of the strengths of the DOD-university relationship is that it is built upon mutual understanding and respect for its common interests. The principal function of a university is education of the young men and women needed by society. Knowledge must be transferred to them so that they may both use knowledge and further develop knowledge. The university is clearly the principal agent of society for supplying education. Concomitant with this role is the university role of scholarly research. Research leads to the knowledge and understanding of various phenomena which form the content of science and the foundation of many of the innovations taking place in society.

Universities have a vital role in the problems faced by society. They must emphasize studies and activities which help to assure the future of society, as contrasted with the short term problems which are the primary work of Government and other non-university activities. Whatever their specific contributions toward solution of problems, this involvement is important in helping assure the relevance of university education, and in assisting in communication between those primarily concerned with generating new knowledge and those using it. This function is particularly important to the engineering and other professional schools, but is also of growing concern to the schools of arts and sciences.

Research support at universities by DOD and other mission agencies is in concert with these university roles. It makes possible a plurality of sources of support for the university researcher, and reduces the possibility that promising research will be overlooked. It also makes available strong continuing support and interest in particular fields of science and areas of investigation judged to be of interest to both DOD and university scientists. Additionally, support through mission-oriented agencies enables many investigators to relate science, technology, and society in a direct manner often not available to the academic scientist. Many researchers are at their best when confronted with a combination of a desire to know and a need to know. This combination can be a doubly motivating force. Finally, mission-oriented support is important in obtaining adequate funds for university research and graduate education. Adequate research support for university work probably can be attained by appropriations only with a general understanding of why and how the research is important. Funding by a mission-oriented agency often helps explain this need.

Many university professors, in their concern to assure the future of society, desire especially to work on the problems of national security, and particularly on the long range ones.

Federal Obligations for University Research and Development, FY 1970, Estimated By Selected Agencies

($ in Millions)

Total		$1,418
Total DOD		223
Army	30	
Navy	77	
Air Force	70	
Other DOD agencies	46	
Health, Education & Welfare		617
National Science Foundation		225
Atomic Energy Commission		100
NASA		110
Agriculture		70
All others		73

Note: Excludes FCRCs
Source: Bureau of the Budget Special Analysis Q

Figure 1.

Academic research can contribute to their solutions in essential ways. University staff members also help provide a bridge between the scientific community with its potentially relevant knowledge and those having need for this knowledge in the applied and development activities necessary for national security.

Thus, by supporting university research in areas judged to be particularly relevant for DOD needs, the defense posture is strengthened by making it possible for some of the country's outstanding scientists and their students to work in areas likely to have great importance to national security. The support assures that both scientific knowledge and educated persons will be available in the scientific fields expected to be most important. In addition, a bridge is maintained between DOD and the universities with many resulting benefits to DOD, such as the availability of expert consultants.

The DOD administration of the university support programs has been especially designed to assure that mutual interests are optimized. For example, since all university basic research sponsored by the DOD is now unclassified, no requirement exists for prior review. Completely open publication is required, either in scientific literature or in the form of technical reports. Formerly, some projects at universities were classified, mainly to give researchers access to information developed under classified projects, but ways have been found to permit access as necessary to classified research information. The security classification question does arise in exploratory development in certain cases and, occasionally, in the application of some of the knowledge gained in basic research. In these instances, no attempt is made to encourage university administrators or faculty members to undertake, or to continue classified research projects in opposition to university policy. All DOD-university contracts are with the institution itself, not with an individual researcher.

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Administration of DOD Support

There are more similarities than differences between the research program managements of the Army, Navy, Air Force, Advanced Research Projects Agency, and other defense agencies. The programs are based primarily on proposals initiated by the university or industry researcher, designated as unsolicited proposals. The prospective principal investigator submits a proposal through his institution in widely circulated fields of active interest indicated by the various DOD agencies. Through this mechanism, a researcher can develop a proposed attack on a scientific problem of his own choosing. Typically, this is phenomena-oriented research in an area in which the investigator has considerable background. He estimates the duration of his proposed effort, the level of effort in terms of his own and his assistant's time, and the equipment involved. This proposal is then forwarded to an appropriate agency.

The researcher's choice of agency to which to send his proposal implies that the DOD agency has done a good job in conveying information to the scientific community on the kinds of research it will support and, particularly, the kinds and nature of the problems it is most concerned with. Before submission, the investigator is encouraged to discuss his proposed work with the staff of the agency to ensure its compatibility with the agency's research program.

The fundamental selection criteria are headed first by the relevance of the research to agency mission and research program needs. Selection of research areas by the DOD agency is a separate topic to be discussed later.

Among the selection criteria for research proposals are scientific quality of the work in terms of current scientific problems. Is the work proposed at the cutting edge of advancing knowledge? In many instances, proposals are submitted to evaluation panels to gain a wider base of opinion of their scientific excellence. From these evaluations and other comparisons, we know that we are getting proposals which rank with the best of any Federal agency. Other criteria are the qualifications and experience of the research staff, the adequacy of facilities, and the reasonableness of costs. Cost is a matter of negotiation, and of willingness of the proposing institution to cost-share some of the research effort. In this way, DOD receives a high rate of return on its research investment.

Interfacing with Users

The key to the effectiveness of the DOD research program is communication. The DOD agency sponsoring the research acts as an interface between the researcher and the user. Hence, staff members of DOD research agencies must have the mission, the experience, and the techniques required to identify DOD problem areas, and to translate them into scientific research opportunities. This interface also functions the other way, *i.e.*, to translate scientific knowledge and understanding into results usable by DOD development laboratories or defense contractors, either industrial or nonprofit.

By properly selecting research activities to support, DOD can help assure the availability of especially relevant knowledge when needed; and also assure communication between the scientific community having the knowledge and the technological community having potential use for the knowledge. This latter activity we designate as coupling.

The greatest challenge that research managers face is the selection

of areas of research. Selection involves the distribution of research resources among the many possible fields and subfields of science. It is part of the central problem faced in the U.S. Federal science policy and in the science policies of most countries. We need the ability to select what society most needs from all the projects that scientists would like to do.

The Air Force is currently giving particular attention to research planning, establishing approximately 40 research planning objectives in the 7 broad areas listed in Figure 2. In each of these areas, we are determining the scientific knowledge needed both to support technical planning objectives of the Air Force development organizations, and to create new technological opportunities. The latter research requirements are more in the nature of scientific opportunities which have some potential for creating new technological fields for future consideration.

We are relating our scientific program to these research planning objectives in interdisciplinary groupings. Groups of work units for appropriate engineering sciences and more fundamental sciences appear to support specific problem areas. As a thorough analysis is made of the needs for science, including that science with potential for creating substantially unknown technological opportunities, management information is obtained which is useful in deciding program distribution. This type of planning requires careful management for its accomplishment, while at the same time assuring the adequate support of more fundamental work so important to our future technological base.

There are many effective mechanisms for coupling science and technology. In his communication role, the DOD scientist maintains his contacts with the DOD applied research and exploratory development community. Many personal contacts are made by visits, correspondence, special reports, program reviews, and participation in joint task groups.

University scientists, who have DOD support, are able to participate directly in DOD activities in many ways. Among these are consulting visits to DOD installations where they may contribute solutions to pinpointed problems. They also serve as members of ad hoc groups to study feasibility of various exploratory development programs; on state-of-the-art reviews, either oral or written; in special purpose symposia which are specifically designed to bring technologists and scientists together; on special lecture tours; in performance of feasibility studies on research phenomena to put them into more readily usable forms; and in direct consultation with aerospace industries. Many scientists find significant satisfaction and stimulation as they make these important, direct contributions to the defense establishment, and to the accumulation of basic knowledge.

Some grants and contracts may be thought of as primarily designed to improve our communication with a particularly fast growing field of science. Many times our resources do not permit us to be pivotal sources of support. But key grants and contracts can give us the insight and first hand knowledge of the field from one or more leaders in that line of research who do keep current. We also sponsor scientific conferences and symposia designed to foster communication within a field and to give us, as DOD project managers, valuable overviews.

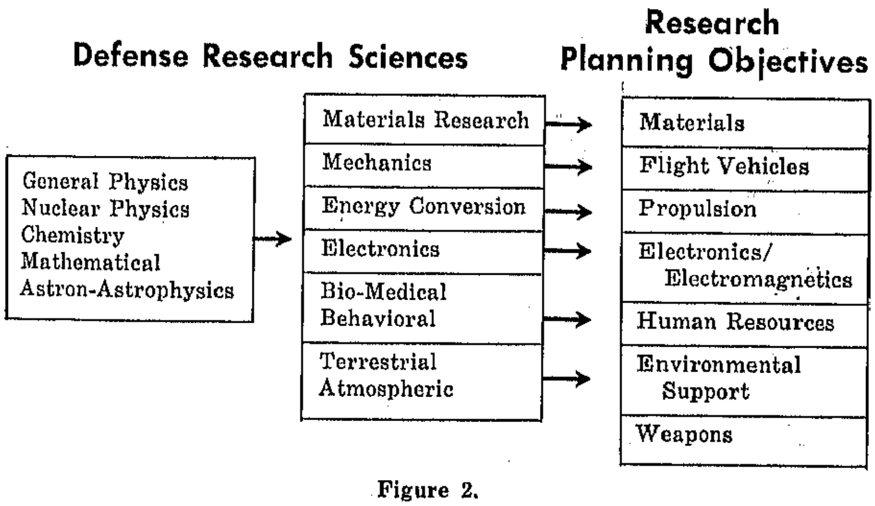


Figure 2.

Conclusions

The continuance of a strong and effective DOD-university relationship based on cooperation is of the highest importance. There is good reason to believe that the profound nature of the mutual interests will demand it. However, potential misunderstanding in some parts of the Congress, the universities, and DOD make it necessary to continue to manage the DOD research program in a way that will ensure maximum effectiveness and credibility.

Recent Congressional legislation provides an example of special need for management emphasis. As a result of Section 203 of the FY 1970 Military Procurement Authorization Act, we are required to document that the research supported by DOD has "a direct and apparent relationship to a specific military function or operation." The impact of Section 203 to date has been to cause realignment of some programs, but it is too soon to tell what the requirement will do in terms of long term research goals. The net effect can be to strengthen the impact of the overall program, but careful management will be necessary to accomplish this without permitting the shorter range projects, with the more readily recognizable payoffs, to squeeze out the more basic research essential for the future.

DOD is doubly challenged to implement Section 203 while, at the same time, it further develops cooperation based on mutual DOD-university interests. The policy, currently being evolved concerning the implementation of Section 203 and future restrictions on the use of military appropriations, is crucial to the long term continuation of the DOD-university programs.

Challenging the Hawk

Colonel Edwin M. Rhoads, USA

A blinding wall of snow crystals driven by gale force subzero winds across a forbidding land of spruce forests, glacier stripped mountains, multichanneled rivers and rocky open stretches deterred even the hardiest of the aborigine children of nature roaming the northern lands. "The Hawk," as these winds were referred to by the Indians of central Alaska, is challenged continually by equally hardy members of today's U.S. Army. The conditions of climate and terrain encountered at Fort Greely, Alaska, home of the Army's Arctic Test Center and Northern Warfare Training Center, are representative of those occurring throughout a large portion of the earth's surface known as the Area of Northern Operations. The testing of equipment to permit our Army to function effectively anywhere within this northern region is the primary mission of the U.S. Army Arctic Test Center, a subordinate agency of the U.S. Army Material Command's Test and Evaluation Command.

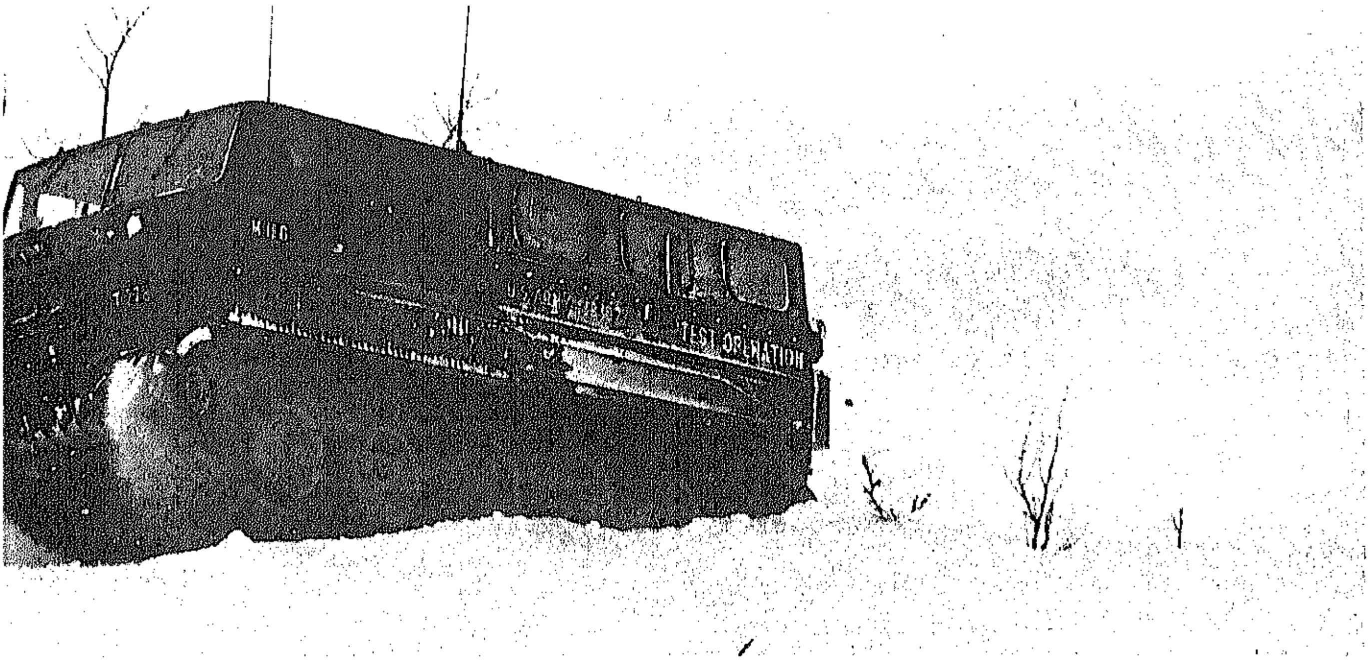
The Area of Northern Operations is the area in the Northern Hemisphere above the temperate zone, where environmental conditions require the application of special techniques and equipment for the conduct of military operations.

During winter, subzero temperatures are prevalent, and exceed —65 degrees F. in the interior of the continental regions and Greenland. Most of the area is covered with snow for three to seven months of the year or more, the snow melting away completely during the summer months. The Greenland icecap, the northern islands, and the high mountain regions have a permanent snow cover. The average snow depth, away from areas of local drifting, is 30 inches, with the greatest annual accumulation occurring between 40 degrees and 60 degrees N. latitude. Inland waterways and the ground surface are frozen from two to nine months of the year. The larger lakes in the southern area are blocked with ice even when not completely frozen over. The occurrence of water fog, ice fog, and blowing snow, added to the long duration of darkness in the higher latitudes, results in a considerable reduction in visibility throughout the winter months. Albeit, reflection by the snow of light from the moon, stars and auroral displays in clear weather greatly enhances night observation.

In summer, the presence of permafrost beneath the thawed surface soil prevents absorption and drainage of melting snow and ice. The result is extensive bogs and marshy areas. These, together with the profusion of lakes, streams and rivers, present formidable barriers to overland movements. They harass the establishment of fixed installations. Twenty-four-hour daylight throughout most of the area, even south of the midnight sun, poses unique problems, as do the myriads of insects during their brief but active season.

These seasonal factors, affecting the conduct of military operations, are compounded by remoteness and long distances, scanty population, and dearth of developed areas, roads and rail nets. Electromagnetic disturbances are aggravated in the polar regions, which often play havoc with radio communications and electronic equipment.

The topographic obstacles to movement of combat forces and logistics support, overland and through the air, are no greater in the northlands than in Southeast Asia. Snow and ice present problems in traction, but offset this detriment by providing an ideal running surface for skis and sleds. Frozen ground is a much better medium for heavy vehicles and aircraft than rice paddies and the summer muskeg swamps of the north. Frozen lakes and rivers are no longer barriers but facilitate movement, although deceptive ice conditions can trap the unwary. The most unhospitable regions of the earth, including both poles and the highest mountains, have been traversed by vehicles, aircraft, or on foot, and technology ex-



ists for the development of military equipment to meet the Army's operational performance requirements, wherever it must fight.

Many Problems Still Exist

Although much of the hostile environment of the north has been conquered, the Hawk's continuing challenge to the developers of military equipment is reliability, dependability, and the compatibility of that equipment with the soldier who must use it.

Sophistication and complexity are inevitable in the achievement of the increased combat power necessary on the modern battlefield, but complex systems often fail drastically under the harsh conditions of low temperatures and restricted visibility. The basic design of equipment intended for sole use in an extreme environment, or a worldwide item which will be a major element of equipment for the military force in that environment, must accommodate the conditions of that environment and the soldier-user. The obstacles must be overcome either inherently or by appropriate kits, *the compatibility of which must be addressed initially in the development process.*

As climatic factors prescribe the Area of Northern Operations, so do they have a primary impact on both the tools of military operations and the soldiers who use them. Extreme cold affects materials and components of military equipment in a number of ways. When subjected to temperatures below —25 degrees F., many types of metals, rubbers and plastics lose their normal properties of strength and resilience, making them unsuitable for their intended purpose. When performance characteristics of materials used in components of military equipment are altered by environmental conditions, the performance of the equipment as a whole is jeopardized. Some of the most frequent defects are more effectively shown than described. There are rubber compounds, plastics and metal alloys suitable for cold weather use, many of which have evolved as a result of our outer space program. The solution is proper selection of materials during a design process that actively considers operations in the northern climates.

Lubricants congeal at low temperatures, losing their lubricating qualities and offering physical resistance to moving parts on military machinery. The substitution of synthetic lubricants for natural petroleum products has been a major advance toward the solution of this problem. The synthetics retain their liquid properties from the extreme cold temperatures encountered to +40 degrees F., eliminating the necessity for frequent oil changes due to temperature fluctuations during the winter months.

The effects of cold on batteries, though well known, still present a serious problem for which no suitable solutions have been offered. Batteries lose their capability to deliver current in direct proportion to decrease in temperature. At —50 degrees F., a fully charged battery shows normal voltage on the voltmeter, but current discharge is nil. Once cold, a storage battery will not accept the charging current rapidly and completely during vehicle operation, unless it is warmed to +40 degrees F. Until a breakthrough is made in the development of small silent power sources, we must stick to electrochemical cells and provide a dependable source of heat to maintain proper operating temperatures.

One of the most nagging problems which has plagued winter military operations is the lack of suitable heaters and winterization kits. Not one of the vehicle heaters currently in the Army inventory has met Army performance requirements, necessitating waivers to get them into the field. Winterization kits all too often are added to vehicles as an afterthought, rather than engineered during the design of the vehicle. Often, reliability of the heaters themselves is considerably less than desired, resulting in frequent failures.

This problem affects all aspects of mobile operations: vehicle starting, crew comfort and even survival during mission operation, standby operation, and maintaining battery power. In addition to improved ruggedness and reliability, a real advance in the design of vehicle heaters would be the provision of standby, low heat operations without drawing on the vehicle battery.

Another persistent and major problem in the northern winter is equipment maintenance. Not only must simplicity and ease of maintenance be the golden rule in designing hardware for the north, but mechanics need portable and easily erected maintenance shelters, safe and dependable heating and lighting, and adequate tools. Normal servicing and minor repair jobs, accomplished in a minimum of time in warm weather, can be excruciating, even impossible, under severe windchill conditions without these additional measures.

Testing in Actual Environment

During the design and engineering development of hardware, exposure to simulated extreme environmental conditions is necessary to ensure that the materials, basic design and components of the item will perform. Proof of the pudding is in the eating, however, and thorough testing in the actual environment is essential to determine the feasibility of test rigs, soundness of engineering, and suitability of the end items in the hands of troops.

Located 105 miles southeast of Fairbanks, Alaska, and 175 miles south of the Arctic Circle, the nearly 1 million acres of the Fort Greely military reservation provide the setting for the conduct of northern area environmental tests. This is the U.S. Army Arctic Test Center, equipped for engineering and service testing of all classes of Army equipment.

Test facilities at the center include instrumented firing ranges for air defense and surface missiles up to 45 kilometers in range, artillery, tanks, mortars and small arms; a 600-acre drop zone; over 100 miles of vehicle road and cross-country courses; a field laboratory for testing vehicle winterization kits and cold starting; and a chemical test area. Instrumentation, including high speed photography, is on hand for technical testing of vehicle and aircraft performance, weapons functioning, communications equipment, chemical items, fuels and lubricants, and water purification systems. Recently a modern instrument calibration facility has been installed.

Because the center has no in-house capability for instrumented testing of rockets, missiles, electronic warfare, or surveillance equipment, the responsible Army developing or processing agency provides the necessary instrumentation and personnel for these tests.

During the past two winters (FY 1969 and FY 1970), more than 100 test programs were successfully conducted.

Some Succeed, Some Fail

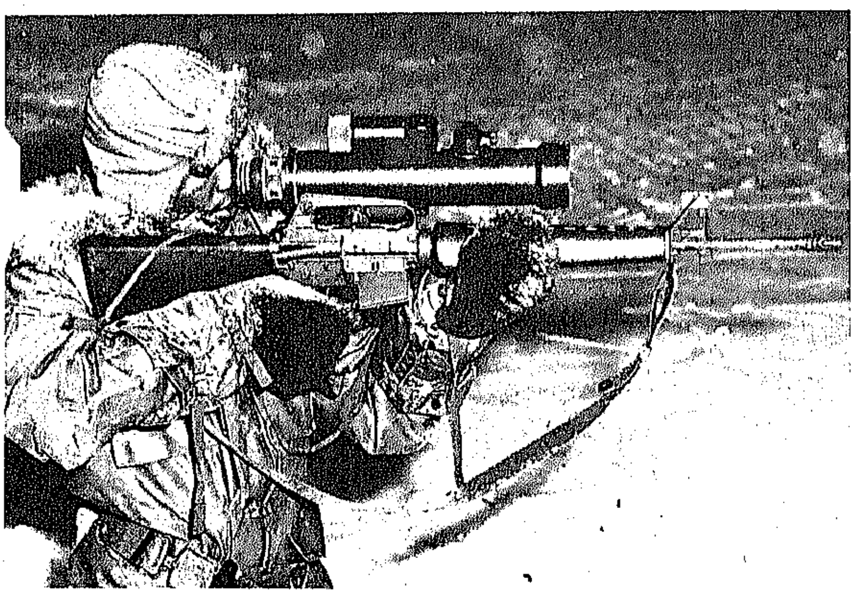
A number of items tested are returned to the center for further testing, after initial evaluations have detected deficiencies in design, winterization and kit suitability, and reliability.

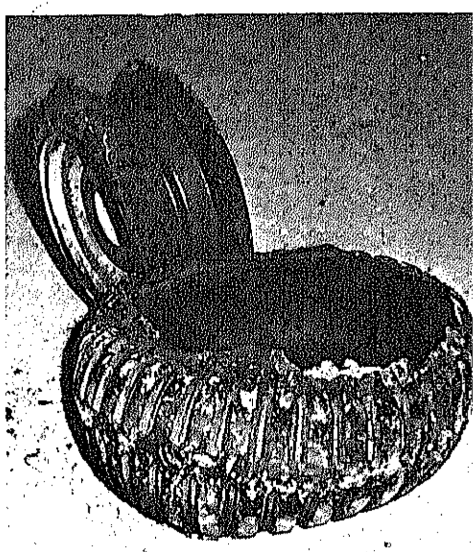
The winterization kit for the M88 recovery vehicle was retested in FY 1969 for the sixth time, and again was declared unsuitable for U.S. Army use in the Arctic. The problem was clearly design in nature. The vehicle is equipped with one heater to supply heat to both engine and crew compartments. In the words of the test officer, "One or the other was always cold."

Exhaust from an auxiliary engine, the "Little Joe," mounted on the M88 was directed by design into the engine compartment to assist in warming the engine. However, the exhaust fumes contained moisture which froze at low temperature. A barrier of ice formed on the engine which prevented warming affect from the exhaust, and added to the load of the overworked heater.

The M551 Sheridan airborne/assault vehicle, also tested in FY 1969, had a winterization kit which was adequate in design. It, too, failed the test at the center because the heaters were unreliable.

In every vehicle tested at the center





during both FY 1969 and FY 1970, heater reliability was a major source of frustration. Heater deficiencies contributed to the unsuitability of winterization kit systems of both adequate and inadequate design.

The CH-54A Flying Crane helicopter was tested at the center during FY 1969 and, although some deficiencies were found, these were corrected and the aircraft was declared suitable for use in the arctic. The Crane performed several actual recovery missions of armored vehicles, and was versatile, reliable, and adaptable to use in extremely cold climates. Today, the Crane is being used successfully in civilian operations in the North Slope oil fields in Alaska above the Arctic Circle.

The center tested the Canadian M571 articulated vehicle, and judged it suitable for U.S. Army use in the Arctic after several easily correctable deficiencies were eliminated. The articulation principle contributed to the outstanding mobility of the vehicle. It was extremely reliable in cold starting. It was used successfully in a variety of roles during the winter, from pulling skiers to hauling equipment and personnel. The only winterization kit problem, other than heater reliability, was the common problem of supplying warmth to batteries. Test personnel redirected some of the hot air from the defrosters to the battery compartment, solving the problem.

During the FY 1970 season, the M35A2C 2½-ton truck was evaluated. Test personnel rerouted the flow of coolant through the engine compartment to make cold starting possible. As designed by the developer, the coolant flowed from the coolant heater to the engine and then to the battery compartment. By the time the coolant reached the batteries, it was too cold to provide the required warmth to enable the batteries to retain their charge. The test group reversed the flow, supplying heat to the batteries first. The coolant reaching the engine was still warm enough to heat the engine adequately.

The 809 series 5-ton trucks tested during FY 1970 were equipped with commercial diesel engines, an off-the-shelf buy by the Army. The engine was highly satisfactory, but heat to the batteries was not adequate, and the heaters were unreliable. Again, the unsuitability of the winterization kit was detrimental to the successful test of the vehicle.

Lightweight loadcarrying equipment for infantry troops, tested this year, lacked durability. It was, therefore, found to be unsuitable although the basic concept is sound. Troops involved in the evaluation had continual problems with "D" rings bending and tearing out under the combat loads. Also, the sizing of the equipment was not adequate, and could not be worn by large men wearing the arctic winter uniform.

Components of the Army Area Communication System were tested at the center during FY 1970, and were functionally suitable for arctic use. Frequency stabilization was good, and the radios were capable of continuous operation for up to 72 hours. Several problems were encountered with small components, which operators had difficulty handling while wearing protective handgear. The shelter heaters supplied for the test were not adequate for the Arctic.

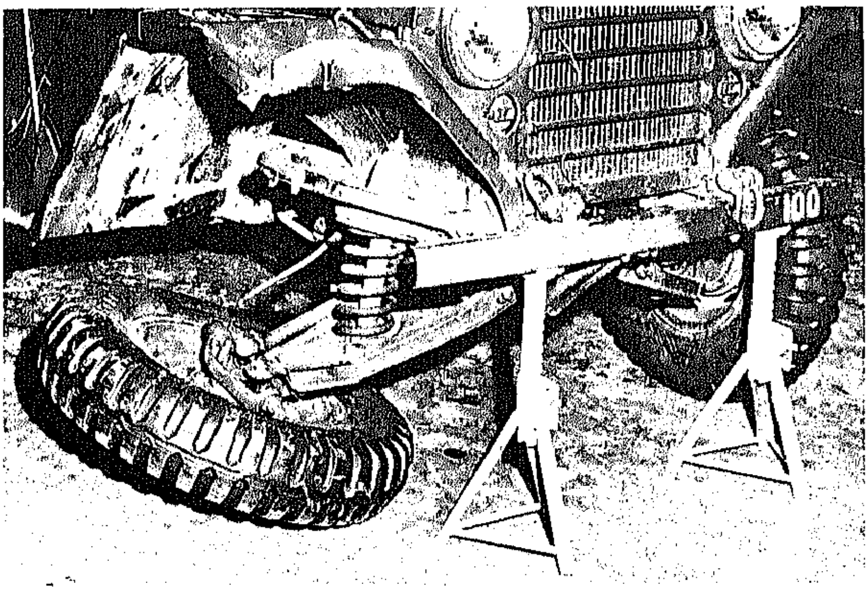
Several rocket and missile systems were tested by the center during FY 1970. They displayed common problems related to rocket motor functioning at low temperatures. The rocket fuel burned more slowly than was expected, and solid propellants would chip and clog the propulsion parts in the motors, resulting in malfunction.

Considering the Human Factor

During the FY 1970 test season, test officers reported numerous human factor engineering failures. Most required actions which could not be performed by operators wearing adequate protective handgear. Common faults were zippers without extensions for gripping with mittens, removable pins which could be grasped only with bare hands, and wing nuts too small for handling with gloves.

Other obvious failures were reported during the test of the Light Observation Helicopter, OH58A, during FY 1970. The drains for the transmission and freewheeling as-

Equipment must be designed for ease of use by a soldier wearing bulky arctic mittens and other protective gear (far left). When subjected to temperatures below —25 degrees F., many type of metals and rubbers lose their normal properties of strength and resilience. Rubber tires can shatter (left) and metal vehicle components can become brittle.



sembly cannot be serviced by a crewman wearing protective handgear. Once opened, the drains spill fluid onto the engine deck. Seepage soon leads to saturation of the passenger's seat inside the helicopter.

The overtemp circuit breaker for the helicopter heater is located behind the soundproofing material in the passenger's compartment. To reset the circuit breaker, the soundproofing material must be removed. The circuit breaker could easily be positioned on the regular circuit breaker panel.

The control box for the same heater is directly behind the pilot's head, and cannot be reached unless the pilot releases all controls and turns completely around. The heater ducting in the aircraft provides too much heat for the pilot, and too little for the passenger.

A glaring human factor and safety fault in the helicopter is the placement of the only fire extinguisher in the passenger's compartment, out of reach of the pilot.

During the FY 1970 test of the M35A2C 2½-ton truck, drivers complained about insufficient leg room

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and interference between brake and clutch pedals, especially when drivers were wearing bulky vapor barrier boots. The test group measured the clearance in the cab and found it to be below the standards set by the Human Engineering Laboratories—an obvious failure to consider the principles of human factor engineering during the design phase.

FY 1971 Test Program

Forty-eight test items will be evaluated at the center during FY 1971, in addition to a number of continuing long range surveillance tests.

The M561 1¼-ton truck intended for forward combat units will be returned to the center for a preproduction test, with emphasis on the new winterization kit. The vehicle employs the articulation principle for steering, and is a wheeled counterpart of the M571 cargo carrier tested in FY 1969.

The M551 Sheridan airborne/assault vehicle will also be returned for tests of the personnel heating system and flame heater. At the same time, the AN/VSS 3 infrared searchlight will be mounted on the Sheridan for testing.

Improved and self-propelled versions of the Hawk air defense missile will be fired at the center by a team from the Air Defense Board at Fort Bliss, Tex.

The center will conduct four communications tests, a continuation of the evaluation of the Army Area Communication System.

The center's test pilots will fly the Huey Cobra (AH-1G) now employed in Vietnam, armed with XM28 and XM18 weapon systems for delivering machine gun, grenade and rocket fire.

Infantry personnel will evaluate the TOW antitank missile and its accessories, in addition to several fuzes, a counter ambush barrage weapon system, grenade launchers and lightweight sleeping gear.

Emphasis on airmobile operations is reflected in five tests related to airdropping of men and equipment. These include a ballistic reserve parachute, airdrop platforms and rigging systems.

Design for Northern Operations

In these and all future tests, the center will continue to look at equipment design for evidence of the application of the lessons learned about northern operations. The materials selected for use must be able to withstand extreme cold without losing their properties and, beyond that, they must be rugged and durable. Adequate winterization kits to provide proper battery heat should be designed into vehicles, not added on in random configurations. All components must be properly tested in cold chambers before environmental testing in the Arctic.

It is clear after 20 years of heater failures of the same nature that a new concept in heaters is called for. The current design has been declared unsuitable and unreliable during every test. An alternative design, utilizing new principles, should be developed.

Soldiers will avoid essential maintenance functions if they are difficult to perform in extreme cold. For this reason, equipment must be designed for ease of maintenance by a soldier wearing the bulky arctic mitten set and other arctic protective gear. Human factor engineering for the Arctic is as important for efficient functioning of equipment as any other design principle.

With the increasing intensity of economic development in the northlands, the military significance of the Area of Northern Operations will increase rather than decrease. The concept of future warfare recently enunciated by the Army Chief of Staff envisions a major increase in surveillance, target acquisition and automated fire control, highly mobile combat forces, and a commensurate increase in the mobility of forward logistic support. Already the capability for airmobile operations, so successfully employed in Southeast Asia, is receiving increased emphasis in the U.S. Army, Alaska.

With proper attention to the northern environment during design and development of the sophisticated weapon and combat support systems of the future, and with thorough testing at the Army's environmental test center in the heart of the North, not only will the Hawk be successfully challenged—it can be an ally of our combat forces against a human enemy anywhere in its domain.

FROM THE SPEAKERS ROSTRUM

Economic Impact of Defense Budget

Excerpt from address by Robert C. Moot, Asst. Secretary of Defense (Comptroller) before the American Ordnance Assn., Washington, D. C., April 30, 1970.

No one needs to be reminded that this is a time of change. Changes are occurring in the world political scene, in the environment, in technology, in national priorities, and in practically every aspect of life. This morning I would like to discuss a change with you that is of central importance to the Defense Department.

The FY 1971 budget represents a dramatic shift in national priorities and the revised Planning-Programming-Budgeting System (PPBS) was a key vehicle used to accomplish this change [See article "PPBS in Defense for the Seventies" *Defense Industry Bulletin*, May 1970, page 1.] A full appreciation of why the change was made can perhaps be best gained by reviewing the relationship between the total Federal budget and the DOD budget during previous war years.

During World War II and the Korean War, rising expenditures for military purposes were partially offset by relative decreases in Federal programs. Military expenditures rose from 16.3 percent of the Federal budget in 1940 to 83.9 percent in 1945. This pattern repeated itself from 1950 to 1953 during the Korean war, with a rise from 27.7 percent to 62.1 percent. During these war years, although the total Federal budget did increase significantly, domestic program funding was reduced or held static.

This pattern was broken, however, with the Vietnam War. Instead of absorbing a greatly increased percentage of the Federal budget, military expenditures actually declined slightly as a percentage of the budget, from 41.8 percent in FY 1964 to 41.5 percent in FY 1969. Domestic program funding actually increased at a greater rate than did the defense program.

Everyone recognizes that there has been a tremendous growth in the Federal budget in the last 10 years. The FY 1971 budget is more than double the FY 1961 budget. In absolute terms, the increase is more than $100 billion—$103 billion to be exact. What few people realize is that most of the increase is due to domestic programs. During this period, defense spending did increase by 61 percent. During this same period, however, domestic programs increased by 143 percent. This represents an increase for nondefense purposes of almost $80 billion out of the total increase of $103 billion. The impact of this pattern of increases on the economy was recognized by President Nixon in his FY 1971 budget message. I quote:

> "The current inflation was generated by the mounting budget deficits and rapid monetary expansion that began in 1965 with the escalation of the Vietnam War and the massive increases in Federal spending for domestic programs."

As you know, President Nixon has made the control of inflation one of the highest goals of his Administration. In bringing inflation under control, we should remember that we are not dealing with a temporary upswing in prices, but that the country has suffered under a sustained inflation for the past few years. Strong measures are necessary to turn this inflationary tide, and they cannot be expected to bring about results overnight.

Probably the most important single tool that the President can use to combat inflation is the Federal budget. There seemed to be little chance to produce a surplus by increasing taxes, since the country was anxious for repeal of the surtax and Congress was in the mood for tax reform. A reduction in the upward trend in Federal outlays was necessary to provide the fiscal restraint which the situation required.

Robert C. Moot is Assistant Secretary of Defense (Comptroller). Previously, he was Chief, Small Business Administration. He has also served as Deputy Administrator of the Small Business Administration and Deputy Assistant Secretary of Defense for Logistics Services.

When the President moves to reduce Federal outlays, he must address programs of the Defense Department. Only slightly more than half of the total Federal budget is controllable. The remainder is based on permanent legislation and includes relatively uncontrollable transfer and income maintenance payments such as social security, medicare, medicaid, interest and farm support. The outlays for these programs are based upon fixed formulas that are established by law and can only be changed through a

necessarily lengthy legislative process. The DOD budget accounts for more than two-thirds of the controllable portion of the budget which buys goods and services for the Federal Government. If a reduction must be made, two out of every three dollars will come from DOD. At the same time, the controllable portion of the budget that is for non-defense purposes includes many important domestic programs to meet the critical internal needs of the country. There is strong pressure to maintain these programs at the budgeted level. Thus, DOD had to fight a war on two fronts—Vietnam and inflation.

FY 1971 Budget

The FY 1969 defense budget of the last Administration cost $78.7 billion. Through reviews of the already submitted FY 1970 defense budget, outlays were reduced by the incoming Administration to $77 billion. The FY 1971 figures are perhaps more dramatic, since they reflect the full year impact of the reductions that were made during FY 1970.

In FY 1971, DOD outlays as a percentage of Gross National Product will be 7 percent. This is down from 8.7 percent in FY 1969, and is the lowest it has been since 1951. This percentage is very meaningful, for it shows how much of our total national output the President is proposing to use for military purposes, in lieu of personal consumption and investment as well as other government programs.

The percentage of DOD outlays to the total Federal budget shows the relative emphasis placed on military spending versus other government programs. For FY 1971, this percentage is 34.6 percent, which is the lowest it has been since 1950. In FY 1969, this percentage was 41.5 percent of the Federal budget.

There are a number of ways of measuring the extent of the reductions that have been made. A straightforward approach is to note that outlays were $78.7 billion in FY 1969 and are estimated at $71.8 billion for FY 1971, for a total decrease of $6.9 billion. However, the forces purchased for $78.7 billion in FY 1969 cannot be purchased in FY 1971 for the same amount, due to pay and price increases. Growth in the number of people receiving military retired pay has also contributed to increased costs and is a factor over which the DOD has no control. These necessary increases amount to $5.9 billion from FY 1969 to FY 1971. When this is added to the actual $6.9 billion reduction, the total reduction in the real defense program from FY 1969 to FY 1971 is $12.8 billion. I should point out that none of these figures include the FY 1971 pay raise [nor the recent 6 percent pay increase following the postal work slowdown].

The cost of inflation can perhaps be best appreciated by comparing the changes in payroll costs and personnel strengths over the past two years. In FY 1969, total DOD pay and related costs were $35.4 billion and military and civilian strength totaled 4.7 million. In FY 1971, pay and related costs will rise to $37.6 billion including the FY 1971 pay raise, while the total end-strength figures will drop to 4.1 million. Stated another way, in two years inflation has cost the department almost 682,000 people and $2.2 billion. Although of lesser magnitude, inflation has also had a similar impact on all other costs.

In addition to reducing the number of people on the direct DOD payroll, we have also estimated that reductions in procurement will cause the dislocation of 640,000 defense contractor and subcontractor personnel, for a total two-year reduction of 1.3 million people.

I believe that this 1.3 million will generally represent a temporary dislocation in the labor force, as these people move from defense-related employment to various tight labor markets. I would like to review very briefly where we currently stand in making these reductions.

Defense Employment Trends

Through the end of March, we had already made more than one-half of the reduction in DOD personnel, reducing 371,000 of the planned 682,000. In the same time period, employment in defense products industries has dropped by 129,000 for a total defense-related reduction of an even one-half million people in eight months.

One method that we are using to gain a better understanding of contractor employment trends is the DOD Economic Information System. Through this system, we receive semi-annual reports from about 450 plants engaged in defense work. Undoubtedly some of you here today submit this report. As of December 1969, employment in these plants was 1,015,000 and accounted for about one-half of the defense contractor employment. Based upon these reports, employment in these plants is projected to be reduced by some 325,000 by June 1971. This correlates closely with our estimate of 640,000 for total defense contractor employment reductions.

The Administration wants to use this knowledge well and do all that it can to avoid adverse economic impacts. The problem is receiving top level attention. An Inter-Agency Economic Adjustment Committee, chaired by Secretary of Defense Laird, has been established at the direction of the President to minimize adverse economic impacts. Every Cabinet department with major domestic programs is represented on this committee. The objective is to design programs that will minimize economic dislocation as resources move from defense to domestic uses.

Indicators of Defense Economic Activity

Our advance indicators of defense industry also tell us that resources will continue to move from defense business to other purposes. These advance indicators move before changes in production activity, so the full impact has not been felt. Let me cite the changes in a few indicators to give you an appreciation of the future. The base is the pre-Nixon year of 1968, compared with the latest monthly data collected by the Department of Commerce[1]:

- Gross DOD Obligations for Procurement—down 30.4 percent.
- Military Primary Contract Awards—down 27.7 percent.
- Unpaid Obligations Outstanding —down 19.9 percent.
- Manufacturers' New Orders for Defense Products—down 34.6 percent.
- Accession Rate—down 23.1 percent.
- Layoff Rate—up 316.7 percent.

[1] *Editor's note: Figures have been updated to reflect most recent data available.*

figures reflect the use of FY ls. The funds earmarked for ent in the FY 1971 budget lower, so the reduction can ed to continue. The DOD FY :urement budget has been re- about one-third from the ıl. The impact of price in- an be eliminated by stating 1971 procurement budget in dollars. The figure is $17.7 hich represents a decrease of ınt.

Postwar Trends

nerging pattern of increas- nployment and decreasing n during the phasedown of a ld not be a surprise. I re- viewed the trends in unem- and the real Gross National after World War II and

rld War II from 1944 to litary purchases were cut 3 percent and unemployment ım 1.2 percent to 3.9 percent. There was a *decrease* of 12 percent in the real Gross National Product.

In the Korean War period from 1952 to 1954, military puchases were cut back by 15 percent and unemployment moved from 2.9 percent to 5.5 percent. There was a *decrease* of 1.4 percent in the real Gross National Product.

In the Vietnam War period from 1969 to 1971, military purchases are being cut back by $6.9 billion in current and $12.8 billion or 16 percent in constant dollars. The Council of Economic Advisers has forecast close to zero growth in real Gross National Product through mid-1970, with some real growth in the latter half of the year. In both of the historical periods, the economy adjusted fairly quickly to the change in national priorities and moved strongly upward.

To summarize, I know that the picture I paint is not rosy from a defense industry viewpoint. It is true that after reassessing national priorities, the President has decided to reallocate some resources from defense to domestic programs. It is true that this will involve large cuts in defense personnel, sharp reductions in defense procurement and, possibly, some temporary added unemployment.

It is also true that the President has taken this action only after carefully assessing our military posture and our international commitments. We must also remember that even after the reductions I have outlined, the defense budget will continue to consume a significant percentage of our total national output.

As it always has in the past, I believe that DOD will once again turn to industry for solutions to the problems we face. Solutions are needed on how to provide adequate defense on a reduced budget. Ways must be found to reduce the cost of new weapons systems.

I am confident that industry will answer this challenge as successfully as it has responded to the challenges of the past.

'ategy of Indirect Approach

ı by Gen. F. J. Chesarek, ımmanding General, Army Command, at Annual Meet- ıe Chicago Chapter of the Ordnance Assn., Chicago, 23, 1970.

veapons and other major materiel are derived from ı's Advanced Concepts Or- ıs—a triad consisting of in- people providing threat the Army Materiel Com- ıdvanced Materiel Concepts ınd the Combat Development 's Institute of Land Combat. ganizations synthesize var- ı concepts with input from the scientific community, ı-house laboratories in order ıe designs of new materiel ine capable of defeating the l threat.

roduct is then critically re- nd designs are selected for ınalysis pertaining to the echnical risk, probable cost, and effectivity. This screening process results in decisions "to go or no go." Then starts the long process of concept formulation, contract definition, engineering development, prototype construction and testing, tooling, more testing to include use of troops, and finally—hopefully—full scale production.

The whole process from birth of a materiel concept to hardware in the hands of troops may take anywhere from 15 to 20 years, if done in an orderly fashion with control of cost, configuration, schedule, and performance.

Obviously, in emergency conditions we would telescope this time frame but would expect to pay a heavy price in cost growth and degradation of performance.

The point I wish to make is that cutbacks in new starts in the 1970s will be felt most in the late 1980s and 1990s. Thus, if we cut back too far in funding for high quality and modern fighting gear, we could well be outclassed in future years.

General Ferdinand J. Chesarek, USA, is Commander, U.S. Army Materiel Command. Previously, he was Assistant Vice Chief of Staff of the Army. A graduate of the U.S. Military Academy, West Point, N.Y., he also holds a Master of Business Administration degree from Stanford University.

In a recent speech to the National Security Industrial Association, Dr. John Foster, Director of Defense Research and Engineering, defined the sweeping challenge from abroad to America's technological leadership. Let me quote a few excerpts from his text:

> "For many years now, the Soviet Union, clearly recognizing a prime source of national strength in the modern world, has emphasized research and development. Soviet expenditures for defense, space, and atomic energy technology have grown until they now exceed ours. Soviet efforts continue to expand rapidly. Our effort has leveled off and begun to decline.
>
> "In civilian technology—particularly in the manufacture of technologically intensive products—Japan, West Germany, and others have achieved and sustained a growth rate several times ours for more than a decade. In selected areas, we no longer lead. We follow. No reversal of this trend is in sight."

Dr. Foster then proceeded to develop his point:

> "In assessing the quality of Soviet defense-related research and development, I can give you two judgments. First, the United States retains a clear but narrowing overall technical lead. But second, the Soviet Union already has the resources and the advanced technology required for a vigorous challenge to the United States in many areas.
>
> "The trend is grim—grim because we Americans have enjoyed a well founded confidence in our ability to meet any challenge in defense, in atomic energy, and in space. In the past, our confidence has sprung from our scientific and technological leadership. The unavoidable question is: Which country will be the more confident in the 1970s and 1980s?
>
> ". . . In military-related research and development, we can be sure about the consequences. With a larger effort, the Soviet Union will explore more areas of science and technology than will the United States. They will study many areas more thoroughly than will the United States. They will learn more. Having learned more, they will find more paths leading to higher performance military hardware of all kinds. Mr. Kosygin's successor will have more choices in his weapons and strategy than will Mr. Nixon's. Then, if the Russians so desired, they could choose to develop and deploy more kinds of advanced weapon systems. Some Soviet choices would be surprises. There would be more Soviet 'firsts' than American 'firsts.' In short, our ability to deter war would be weakened. The risks of war would rise."

Now, neither Dr. Foster nor I intend to sound the call of doomsday. Rather, we seek to inform our fellow citizens of the challenge and set it in proper perspective.

Frank Lloyd Wright once said:

> "The human race built most nobly when limitations were greatest, and therefore when most was required of imagination in order to build at all."

There are a number of things we can do, with the help and understanding of our friends, to maintain a high quality, modern Army within reasonable budget constraints. The direction could be labeled "a strategy of indirect approach". Let me explain.

During the period 1960 to 1965, the Army's budget, averaged out over these five years, breaks out as follows: pay of our people—40 percent; operating costs—30 percent; investment in facilities and equipment—19 percent; and research and development—11 percent.

As the resources allocated to us decline, and as inflation in both wages and materiel continues, we not only have less to apportion to these accounts, but we get less for each dollar allotted.

The big money—70 percent—is in pay and operating costs. We must, therefore, devise ways and means of using less people to do our tasks and better ways of doing them, not only to live within our budget but at the same time generate substantial funds for a viable research and investment program.

This is the strategy of indirect approach. To a nation of innovators, entrepreneurs, and managers, this is a tolerable challenge. I would like to outline a few of the opportunities which should make this strategy successful.

Computers and ADP Equipment

First, expand and exploit the use of the computer and other automatic data processing equipment where we currently enjoy a strong international lead and where the payoff is very promising.

Recently, Dr. Glenn T. Seaborg, Chairman of the Atomic Energy Commission, in a speech at the Nobel Symposium in Stockholm, addressed this subject, and I would like to quote a paragraph of his address:

> "One particular way in which the computer will serve . . . is by allowing us to create projections of possible futures or models of complex systems. These processes might be considered as an aid to—or perhaps a synthetic form of—wisdom. They give us a greater ability to look into the future in terms of what might happen should we act or not act in certain ways. . . . We can project alternatives, evaluate them, and offer people a choice. . . . In the future, we will have to depend on the computer to correlate the studies of all the experts, rather than depend on limited individual knowledge or often unreliable speculation."

In the Army, we are now proceeding along this line across the whole spectrum of our activities. We use computers in complex modeling work and simulations of all kinds. As our skill improves in their use and exploitation, we are able to solve complex, time-consuming problems quicker, provide better alternative choices, and make better analyses—in other words, reduce the long lead times which translate into dollars and people.

In the logistical areas, we are completing this month the programming of third generation computers for our

National Inventory Control Points and our depots. In the near term, this will permit consolidations with substantial strength reductions, increase our responsiveness to the field forces, and give us the kind of visibility we need to manage our resources better.

In our maintenance shops and arsenals, we are pushing hard for conversion to computer aided manufacture. Numerically controlled machine tools can produce big savings in our operating account and permit quick amortization, as well as aid in meeting our customers' demands.

Computers are helping us greatly in control, simplification, and production of technical data and its maintenance. Computer aided design will certainly become a standard way of business over the next 10 years.

In short, computers provide opportunities for major tradeoffs against units and strength. Properly and imaginatively utilized, they let us do more, much better, much faster, and with much less.

People and Machines

Another major area of great potential to permit man-machine tradeoffs is in designing simple, highly reliable, easily maintainable materiel. Reams have been written on this worthy objective with little done about it, either in the commercial or military sector. We and industry are both at fault. Because of the long lead time involved in weapon system development, there are strong tendencies to push the outer reaches of the state of the art and to incorporate in each system multiple capabilities. This adds up to highly sophisticated, complex, and very expensive equipment.

We are now in the process of taking a different course which will field quality materiel and substantially reduce cost in people and dollars. All of our new starts specify, in quantifiable terms, the reliability demanded. We have set up procedures to control changes and freeze designs at an early stage in the cycle. We are well into modular replacement to eliminate the need for hundreds of thousands of repair parts. The new creed is to produce simple, reliable, quality products. This will act to reduce the size of operating crews, save hundreds of thousands of maintenance hours, and reduce logistics support.

Logistics

A third major area for innovation is in the exploitation of containers.

Years ago, the Army invented the CONEX container—a steel box measuring about 8-by-8-by-4 feet—in which we transported fragile items such as communications gear and pilferable materiel. In recent years, we have been using them quite generally for the movement of cargo. About five years ago, an international effort was applied toward a standard container, which could be transported by rail, sea, air, or truck, regardless of the various national standards which tend to inhibit this sort of thing. At the present time, 24 percent of our cargo, exclusive of ammunition and major end items, moves to Vietnam by containers on ships especially designed for their quick loading and off-loading. Fifty-two percent of similar cargo destined for Europe is shipped by containers.

This is just a beginning in reducing double and triple handling, port charges, and other heavy expenses of break-bulk operations. In FY 1969, the Army spent about $2 billion for the transportation of people and things, so the stakes are high indeed.

The time has come to exploit the container to its full potential. . . .

I visualize a depot in any future contingency to consist of a group of specially built containers, carefully stocked and documented in the United States and delivered to designated points. The need for depot construction, ports, or over-the-beach operations will be sharply reduced. Similarly, containers can be used as maintenance facilities where each can be designed in the United States as a segment of a maintenance shop. Thus, we can safely reduce the requirements for special materiel to build depot and maintenance facilities, and save the cost of keeping them in a condition for immediate use.

This form of podularized logistics is cheap to construct, relatively indestructible, secure from pilferage and other loss, and can be accomplished in a fraction of the time currently employed. They may take the form of being encased in large air inflatable shelters for weather protection, air conditioning, or heat. Savings could amount to hundreds of millions of dollars.

Lasers

Next, we need to press forward with the exploitation of lasers. This fantastic phenomenon is just beginning to find itself. It not only measures distances with extreme accuracy, it also is being applied as a metal cutter on machinery in numerically controlled tools, for difficult welding operations, on construction equipment as horizontal reference means, for three-dimensional photography, and in the field of medicine. It has innumerable communications and computer memory potentials. Each of these applications saves people, money, and time—the key ingredients.

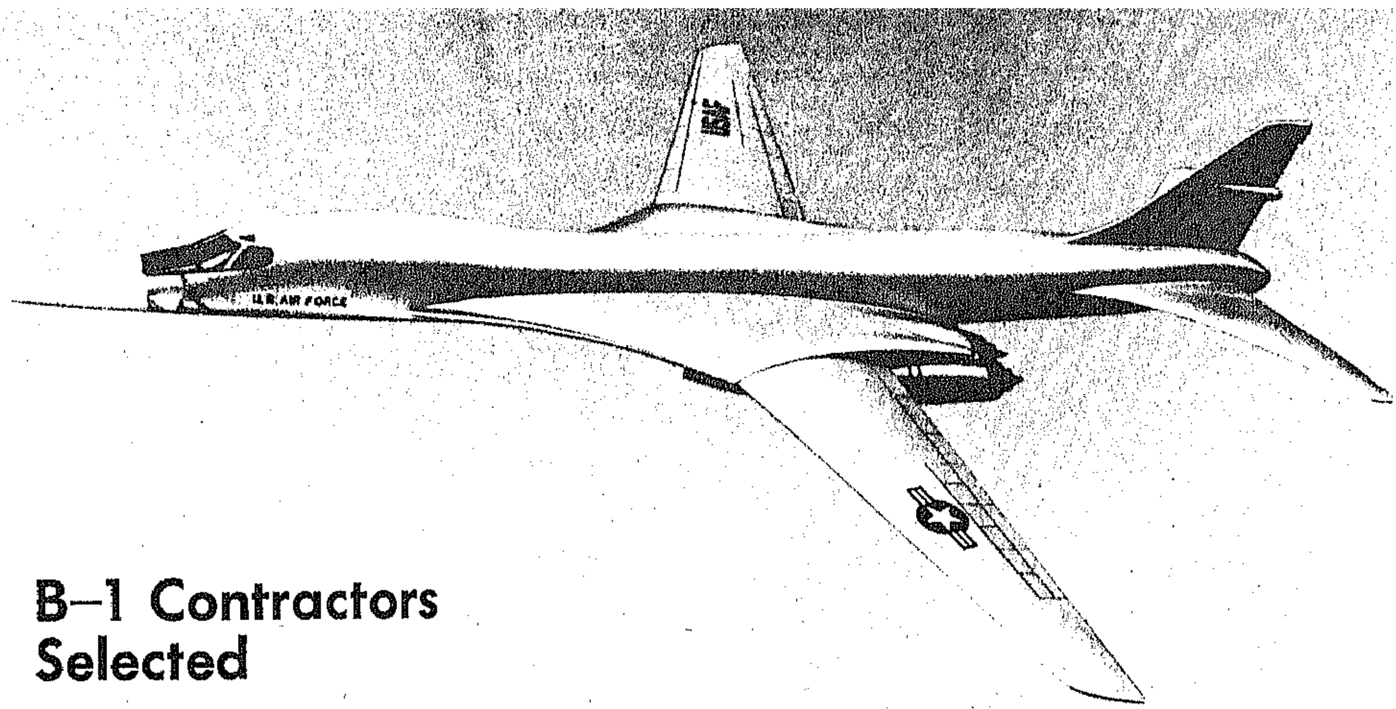
Future Priorities

I hope these few examples give you a fair idea of our approach. If our efforts prove successful, and I believe they will, we should generate a reasonable sum of money for equipment modernization. I know you are most interested in how we intend to use these funds.

I would hope to apply a high priority to the development and production of a new generation of munitions to increase effectiveness by a factor of four or five. We have made some breakthroughs during the past five years which open a new world in this complex area. Firepower equates to strength. After all, that's what all the effort is aimed at doing—overpowering the enemy.

The Army's priorities continue to place emphasis on air mobility, especially the helicopter gunship. Devices to improve our battlefield surveillance, night observation, and real time intelligence also enjoy high priority. Our efforts at developing better tank and antitank systems are well along with some now entering production. They must be funded. Similarly, we cannot afford to lack effective air defense systems. Anyone who has experienced attack from the air knows its devastating power. As these systems are expensive, little is likely to be left for other desirable programs.

For years we have boasted that our soldiers are the finest equipped in the world. Will they be in the following decades?



B–1 Contractors Selected

The Air Force has selected airframe and propulsion contractors for engineering development of the B-1 advanced strategic bomber. The contractors are North American Rockwell Corp., El Segundo, Calif., for the airframe; and the General Electric Co., Evendale, Ohio, for the engines.

No production was authorized, nor has there been a decision on whether or when production might begin or how many aircraft might be required. Funds for engineering development were approved by Congress in the FY 1970 budget.

In his authorization to proceed with the B-1 program, Deputy Secretary of Defense David Packard stated that "It will be several years before a production decision will be made. Factors to be considered in authorizing a production decision will include progress and success of the engineering development program, the progress of the SALT talks, and the relationship of this program to these talks."

Secretary Packard instructed Secretary of the Air Force Robert C. Seamans to "take appropriate action to assure that the contractor minimizes expenditures until: there is final Congressional action on the FY 1971 budget for this program; [and] the development schedules have been re-evaluated as necessary to reflect these Congressionally approved funding levels." He also required that "Equal opportunity compliance of both contracts must be reconfirmed before the contract is signed."

If changes in the funding situation require significant changes in schedule or cost estimates, the program must be reviewed by the Defense Systems Acquisition Review Council.

North American Rockwell Corp. will initially proceed with engineering and design, including fabrication of five flight test aircraft, one static test airframe and one fatigue test airframe, to be used in development testing. Total cost of the airframe work announced is estimated at $1,350,814,739. This total includes a target fee of $115,753,281, and funds for spares and special equipment to support the test program. It does not include cost of avionics. Initially $25,000,000 were obligated for airframe engineering development.

The General Electric Co. will begin engineering design, development and fabrication of 40 preliminary flight-test-rated engines for the flight test program. Total estimated cost is $406,654,000, which includes a target fee of $30,122,500, and funds for spares, and special support and test equipment. Initially, $10,000,000 were obligated for engine development.

The contracts will use cost plus incentive fee features, plus an award fee feature for outstanding overall accomplishment.

A contractor for the avionics will be selected at a later date.

System program director for the B-1 is Brigadier General Guy M. Townsend of the Air Force Systems Command.

Based on comparative costs of developing other new aircraft, and without benefit of contractor proposals, the Air Force estimated the total cost of B-1 production (at least 200 aircraft) would be $11.8 to $12.6 billion in 1968 dollars:

- Research, design, development, test and evaluation, and five test aircraft—$1.7 to $1.9 billion.
- Investment in aircraft, including initial spares, technical data and support equipment—$6.8 to $7.2 billion.
- Operation for 10 years—$3.3 to $3.5 billion.

These estimates do not include inflation factors, as budgets are not developed on the basis of projected inflation.

Over the past four years, the Air Force has spent more than $140 million for preliminary system design studies, and avionics and propulsion advanced developments, to identify and reduce technical risks. Seven spe-

cific avionic advanced development tasks, costing $42 million, have been completed or are in various stages of flight test.

In the propulsion area, about $72 million has been spent for design, fabrication and test of propulsion components and for demonstrator engines which closely approximated the size and cycle envisioned for the B-1. Several hundred hours of running time have been accumulated on these demonstrator engines.

The Air Force wants the B-1 to modernize the manned bomber element of the nation's strategic force by replacing the B-52. By the time operationally significant numbers of B-1s could be in the inventory, in CY 1977 or 1978, the newest of the B-52s would be 15 years old. The B-52H incorporates about the maximum growth attainable with the basic design, and represents the technology of the 1950s. If all technical milestones in the development of the B-1 are met, the first flight could be in June 1974.

As presently planned, the B-1 will be a supersonic bomber in the Mach 2 to 3 range at high altitude. Powered by four turbofan engines, the B-1 will have a gross take-off weight of 350,000 to 400,000 pounds, about two-thirds of the weight of the B-52. It will also be smaller than the B-52. The aircraft will be manned by a crew of two pilots and two navigator-systems officers.

The B-1 is planned to have an internal bomb bay about twice the size of the B-52. It will carry short range attack missiles (SRAM), subsonic cruise armed decoys (SCAD), bomber defense missiles (BDM), and nuclear and conventional weapons. It will also be able to carry external payloads.

In comparison with the B-52, the B-1 will have a smaller radar cross-section, penetrate at higher speeds and lower altitudes, be able to operate from dispersed austere bases, carry a greater payload, and be capable of more rapid launch. It will have high lift devices and short take-off and landing capabilities.

The aircraft will feature ability to shift and adapt range, altitude, and speed and payload for a variety of missions and tactics. It will contain electronic jamming equipment; infrared countermeasures; radar location, homing and warning; and other devices to protect itself, penetrate enemy defenses, and deliver its payload.

The national strategic force consists of bombers, land-based missiles and sea-based missiles. Manned bombers give the Air Force operational flexibility. They can be launched to test operational readiness, or to provide a show of force or level of readiness. They can be recalled to base prior to actual commitment of force.

Bombers can be used in conventional role or limited nuclear exchange where extreme accuracy is required. They can be assigned multiple targets or alternate targets as dictated by a changing tactical situation. Bombers can be recovered, reconstituted, and used to strike additional targets.

Winning B–1 Proposal Had Highest Rating, Lowest Bid

The following statement was issued by the Air Force on June 8:

"It has been reported that the bid of the winner in the B-1 competition was the highest bid and presented the least desirable design.

"This is not the case.

"North American Rockwell Corp. was the lowest bidder, received the highest weighted score, and was the unanimous choice at each reviewing level.

"When the contractors submitted their proposals, some 600 selected specialists reviewed and evaluated them over a period of months. The proposal was divided into a large number of sub-areas and basic evaluation scores were rendered by separate evaluation groups after they analyzed each of the sub-areas.

"These raw data were consolidated and presented to the Source Selection Advisory Council. After hearing the presentation of the evaluation group, the Source Selection Advisory Council went into executive session. In this executive session, the Advisory Council applied weighting factors to the raw evaluation date. These weighting factors had been created before contractors' proposals were received.

"They were not changed and were never made available to the members of the evaluation team which conducted the detailed analysis.

"The results of the Source Selection Advisory Council were formalized in writing and presented to the Secretary of the Air Force, who had the authority to select the winning contractor. In addition, this analysis and findings were presented to the Commander, Strategic Air Command, Commander, Air Force System Command, Commander, Air Force Logistics Command, the Air Force Council, and the Chief of Staff.

"All these individuals, as well as the Air Force Secretary's principal civilian advisors, reached the same conclusion as Secretary Seamans with respect to the contractor's proposal to be selected.

"The North American Rockwell Corp. received the highest weighted score of the three proposals and their negotiated bid was the lowest—some $1.35 billion compared to $1.45 billion and $1.56 billion for the other competing contractors.

"The contract is for development and testing of the new aircraft only. No decision has been made on whether production will be authorized."

We Apologize!

In May the *Bulletin* published a list of the NATO member countries (see NATO Industrial Advisory Group, p. 15). We unintentionally used incorrect names for four countries. We apologize, and correct the error with the following list of member countries:

Belgium
Canada
Denmark
France
Federal Republic of Germany
Greece
Iceland
Italy
Luxembourg
The Netherlands
Norway
Portugal
Turkey
United Kingdom
United States of America

Status of Funds Quarterly Report

Outlays

Third Quarter, Fiscal Year 1970

(Thousands of Dollars)

Department of Defense	Outlays				Unpaid obligations	
	Jan 1970	Feb 1970	Mar 1970	Cum thru 31 Mar 1970	At start of year	As of 31 Mar 1970
Military Personnel						
Active forces	1,801,712	1,722,760	1,741,215	15,997,638	592,306	677,350
Reserve forces	77,242	54,137	75,804	761,186	152,294	151,936
Undistributed	17,896	−62,533	−26,588	−112,515	—	112,515
Total—Military Personnel	1,896,350	1,714,364	1,790,431	16,646,309	744,601	941,800
Retired Military Personnel						
Retired Pay, Defense	244,551	247,966	246,092	2,100,805	6,354	9,259
Operation and Maintenance	1,736,207	1,717,217	1,745,680	16,062,530	3,924,991	3,775,443
Procurement						
Aircraft	621,153	506,622	711,127	5,948,184	7,701,062	5,427,147
Missiles	224,950	219,585	244,955	2,094,993	2,516,998	2,649,172
Ships	168,288	176,487	216,921	1,594,934	3,085,253	2,962,920
Tracked combat vehicles	24,224	32,667	26,079	219,647	454,414	368,201
Ordnance, vehicles and related equipment	444,176	450,376	441,071	3,800,999	5,690,581	4,710,339
Electronics and communications	98,490	92,915	115,119	851,832	1,621,409	1,448,009
Other procurement	199,960	130,080	124,165	1,421,787	2,016,381	1,921,572
Undistributed	−82,784	22,926	155,238	527,065	128,925	−256,737
Total—Procurement	1,698,457	1,631,657	2,034,673	16,459,441	23,215,023	19,230,625
Research, Development, Test, and Evaluation						
Military sciences	93,738	66,270	93,013	685,960	712,919	609,055
Aircraft	71,822	102,097	117,022	904,378	681,935	874,974
Missiles	154,987	194,722	173,304	1,658,665	1,077,605	1,191,274
Astronautics	52,453	68,964	44,961	595,995	452,428	405,994
Ships	32,261	29,290	38,990	267,166	284,836	281,588
Ordnance, vehicles and related equipment	26,621	28,519	27,369	243,021	229,411	177,522
Other equipment	69,353	68,721	76,922	678,858	501,780	477,709
Program-wide management and support	60,835	30,793	38,027	347,586	282,019	215,214
Undistributed	−7,322	−3,812	11,446	40,750	38,151	−11,190
Total—Research, Development, Test, and Evaluation	564,747	580,564	616,057	5,422,387	4,261,084	4,223,137
Military Construction	99,899	59,148	89,637	914,010	1,806,093	1,565,153
Family Housing	51,678	45,529	52,858	464,535	256,946	164,480
Civil Defense	6,222	6,419	7,724	60,028	55,255	49,298
Other—Special Foreign Currency Program	137	44	137	598	363	507
Revolving and Management Funds	160,245	−37,561	−197,004	−219,389	6,615,240	5,613,032
Applicable Receipts	−30,862	−9,639	−8,359	−107,906	—	—
Subtotal—Federal Funds	6,417,630	5,955,709	6,377,926	57,803,358	40,885,950	35,572,731
Trust Funds	1,362	−1,059	−1,010	3,125	4,821	3,919
Interfund Transactions	—	−2,049	−1	−4,662	—	—
Total—Military Functions	6,418,993	5,952,600	6,376,916	57,801,821	40,890,771	35,576,650
Military Assistance						
Federal Funds	31,841	57,901	37,214	423,693	1,562,839	1,288,909
Trust Funds	23,727	17,974	4,658	41,105	227,015	195,806
Total—Military Assistance	55,569	75,874	41,872	464,798	1,789,854	1,484,715
TOTAL—DEPARTMENT OF DEFENSE	6,474,560	6,028,475	6,418,789	58,266,620	42,680,624	37,061,364

'epartment of the Army

litary Personnel						
Active forces	723,573	733,088	745,701	6,507,465	213,798	292,752
Reserve forces	38,426	39,686	46,551	495,522	115,658	112,837
Undistributed	17,836	−58,662	−28,707	−124,183	—	124,183
Total—Military Personnel	779,835	714,112	763,545	6,878,804	329,457	529,772
Operation and Maintenance	605,128	677,922	602,855	5,758,965	1,337,348	1,226,597
Procurement						
Aircraft	69,210	52,663	57,854	632,273	1,063,782	708,264
Missiles	61,010	54,765	46,686	490,168	848,404	954,986
Tracked combat vehicles	23,408	32,042	24,201	206,992	481,068	340,447
Ordnance, vehicles and related equipment	264,118	199,395	176,744	1,741,298	2,965,280	2,349,294
Electronics and communications	31,677	27,350	22,335	260,437	581,475	453,528
Other procurement	45,320	40,575	25,552	312,744	682,896	709,162
Undistributed	−68,519	−6,086	152,425	483,915	39,722	−300,878
Total—Procurement	431,824	400,705	505,796	4,127,827	6,612,627	5,214,809
Research, Development, Test, and Evaluation						
Military sciences	11,328	10,998	13,689	104,965	96,888	93,664
Aircraft	5,733	4,947	15,736	60,293	89,782	78,512
Missiles	47,788	88,628	62,223	606,950	419,831	519,068
Astronautics	148	995	1,248	5,682	3,813	3,006
Ordnance, vehicles and related equipment	15,864	15,422	14,917	127,757	115,667	88,811
Other equipment	30,540	30,247	29,794	260,607	196,095	166,048
Program-wide management and support	4,369	3,957	4,781	42,125	32,104	30,548
Undistributed	12,371	−15,240	10,430	32,531	13,651	−23,842
Total—Research, Development, Test, and Evaluation	128,080	139,950	162,818	1,240,910	967,881	955,815
Military Construction	37,473	30,424	31,807	344,986	776,104	783,896
Revolving and Management Funds	16,620	−16,542	−73,393	47,132	1,856,891	1,436,386
Applicable Receipts	−28,085	−4,458	−2,730	−59,250	—	—
Subtotal—Federal Funds	1,970,883	1,942,114	1,980,198	18,334,374	11,880,257	10,147,276
Trust Funds	913	−1,266	−1,081	1,339	89	−376
TOTAL—DEPARTMENT OF THE ARMY	1,971,795	1,940,847	1,979,118	18,355,713	11,880,346	10,146,900

Department of the Navy

	Outlays				Unpaid obligations	
	Jan 1970	Feb 1970	Mar 1970	Cum thru 31 Mar 1970	At start of year	As of 31 Mar 1970
Military Personnel						
Active forces	554,617	469,168	478,849	4,688,261	168,734	273,855
Reserve forces	26,277	638	15,300	129,596	23,320	26,428
Undistributed	−5,746	4,366	−7,817	7,074	—	−7,074
Total—Military Personnel	575,149	474,171	486,331	4,824,930	192,054	293,209
Operation and Maintenance	437,246	432,157	468,396	4,219,348	1,537,613	1,521,299
Procurement						
Aircraft	187,097	179,589	215,360	1,809,119	2,861,615	2,115,068
Missiles	65,482	45,754	65,815	497,674	703,716	677,773
Ships	168,288	176,487	216,921	1,594,934	3,085,253	2,962,920
Tracked combat vehicles	816	625	1,878	12,655	23,346	27,754
Ordnance, vehicles and related equipment	87,126	111,935	145,283	1,055,045	1,586,287	1,316,406
Electronics and communications	84,287	39,112	50,746	319,900	576,715	528,643
Other procurement	96,948	51,185	79,900	707,141	1,194,841	1,079,449
Undistributed	−12,261	25,842	2,512	32,970	71,369	35,003
Total—Procurement	627,783	630,527	778,416	6,029,438	10,053,142	8,743,016
Research, Development, Test, and Evaluation						
Military sciences	14,626	14,301	11,689	123,318	129,992	108,544
Aircraft	36,692	39,590	66,940	394,169	253,929	506,141
Missiles	34,673	35,063	37,559	381,489	291,240	278,320
Astronautics	2,180	584	1,907	13,629	15,598	17,461
Ships	32,261	29,290	33,990	267,166	284,836	281,588
Ordnance, vehicles and related equipment	10,757	13,097	12,452	115,264	113,744	88,711
Other equipment	16,112	15,079	18,606	136,020	77,139	144,268
Program-wide management and support	19,860	4,460	9,696	77,210	219,464	153,966
Undistributed	−11,925	8,980	1,294	2,894	14,446	8,603
Total—Research, Development, Test, and Evaluation	155,286	160,444	194,133	1,511,159	1,400,388	1,587,602
Military Construction	33,494	3,292	34,610	262,963	616,207	581,034
Revolving and Management Funds	80,692	−170	−30,382	12,968	2,199,935	1,972,138
Applicable receipts	−2,106	−3,480	−2,571	−29,863	—	—
Subtotal—Federal Funds	1,907,495	1,696,940	1,928,938	16,830,943	15,990,338	14,698,297
Trust Funds	807	555	355	4,688	277	376
Interfund Transactions	—	−2,049	−1	−4,662	—	—
TOTAL—DEPARTMENT OF THE NAVY	1,908,301	1,695,447	1,929,288	16,830,970	15,999,615	14,698,673

Department of the Air Force

Military Personnel						
Active forces	523,522	520,505	516,668	4,801,911	209,774	110,742
Reserve forces	12,539	13,813	13,953	136,068	13,316	12,671
Undistributed	5,306	−8,237	9,937	4,595	—	−4,595
Total—Military Personnel	541,367	526,080	540,554	4,942,574	223,090	118,819
Operation and Maintenance	594,872	522,880	669,835	5,295,362	953,240	902,787
Procurement						
Aircraft	364,846	274,370	437,913	3,506,792	3,775,665	2,603,815
Missiles	97,858	119,066	132,454	1,107,151	964,878	1,016,413
Ordnance, vehicles and related equipment	92,845	139,013	119,002	1,004,048	1,188,875	1,044,544
Electronics and communications	32,360	26,136	41,504	266,769	455,843	460,674
Other procurement	49,265	31,526	14,116	345,574	95,195	89,036
Undistributed	−6,691	3,145	346	10,171	17,834	9,142
Total—Procurement	630,483	593,255	745,395	6,240,505	6,498,290	5,223,625
Research, Development, Test, and Evaluation						
Military sciences	14,315	11,267	12,302	106,345	90,842	82,127
Aircraft	29,397	57,560	34,346	449,916	338,224	290,321
Missiles	72,576	71,031	73,522	670,226	366,534	393,886
Astronautics	60,126	62,385	41,806	576,684	433,017	386,527
Other equipment	22,701	23,395	28,522	282,231	228,546	167,393
Program-wide management and support	36,606	22,376	23,550	228,251	30,451	30,700
Undistributed	−7,768	2,448	−278	5,325	10,054	4,049
Total—Research, Development, Test, and Evaluation	217,953	250,462	213,772	2,318,980	1,497,668	1,355,001
Military Construction	27,968	24,671	22,868	297,331	393,810	186,210
Revolving and Management Funds	39,560	10,079	−87,725	−266,155	1,276,941	1,336,484
Applicable Receipts	−669	−1,699	−3,056	−18,774	—	—
Subtotal—Federal Funds	2,051,033	1,925,729	2,001,583	18,749,824	10,843,039	9,122,924
Trust Funds	−358	−348	−284	−2,902	4,323	3,918
TOTAL—DEPARTMENT OF THE AIR FORCE	2,050,674	1,925,382	2,001,300	18,746,923	10,847,362	9,126,842

Defense Agencies/Office of the Secrtary of Defense	Outlays				Unpaid obligations	
	Jan 1970	Feb 1970	Mar 1970	Cum thru 31 Mar 1970	At start of year	As of 31 Mar 1970
Operation and Maintenance	96,597	80,947	101,285	822,863	93,268	128,187
Procurement	87	38	42	608	189	95
Ordnance, vehicles and related equipment	166	317	534	4,726	7,876	5,164
Electronics and communications	8,427	6,794	4,597	56,328	48,449	48,925
Other procurement	-318	25	-45	9	—	-9
Undistributed						
Total—Procurement	8,367	7,169	5,127	61,671	50,964	49,176
Research, Development, Test, and Evaluation	58,469	29,709	55,388	851,338	395,197	324,720
Military sciences	968	761	851	8,729	19,972	14,014
Military Construction	23,378	-30,927	-5,504	-13,334	1,281,474	868,024
Revolving and Management Funds	-1	-3	—	-17	—	—
Applicable receipts						
Subtotal—Federal funds	182,769	87,657	157,040	1,231,249	1,840,875	1,879,119
Trust funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	182,769	87,657	157,040	1,231,249	1,840,875	1,379,119

Defense-Wide

Military Retired Personnel	244,561	247,966	246,092	2,100,805	6,364	9,259
Operation and Maintenance	2,864	3,311	3,369	31,001	3,523	1,578
Family Housing	51,678	45,529	52,858	464,585	256,946	164,480
Other Special Foreign Currency Program	137	44	137	598	363	507
TOTAL—DEFENSE-WIDE	299,231	296,850	302,446	2,596,939	267,186	175,818

Office of Civil Defense

Civil Defense	6,222	6,419	7,724	60,028	55,255	49,298

Obligations

Department of Defense	Available for obligation	Obligations			Cum thru 31 Mar 1970	Unobligated balance 31 Mar 1970
		Jan. 1970	Feb. 1970	Mar. 1970		
Military Personnel						
Active forces	20,021,084	1,817,784	1,757,667	1,746,440	16,343,511	3,677,523
Reserve forces	1,020,605	71,612	73,328	81,079	768,987	251,018
Total—Military Personnel	21,041,689	1,889,394	1,830,996	1,827,519	17,112,498	3,929,141
Retired Military Personnel						
Retired Pay, Defense	2,735,000	244,961	248,671	246,566	2,103,431	631,569
Operation and Maintenance	23,226,114	2,076,294	1,548,787	1,754,186	17,514,210	5,711,904
Procurement						
Aircraft	10,080,053	585,039	321,844	598,580	4,018,360	6,061,692
Missiles	4,103,069	139,687	220,546	132,460	2,281,281	1,821,887
Ships	5,011,431	210,897	109,494	118,089	1,541,929	3,469,502
Tracked combat vehicles & other weapons	367,526	24,637	13,814	16,269	201,252	166,274
Ordnance, vehicles and related equipment	6,830,441	355,209	297,305	285,860	4,104,779	2,725,662
Electronics and communications	2,202,752	104,985	71,215	71,771	771,016	1,431,736
Other procurement	3,077,726	140,223	132,655	265,237	1,567,259	1,510,467
Undistributed	-381,831	887	-1,730	3,903	-1,742	-380,089
Total—Procurement	31,291,168	1,561,060	1,164,588	1,427,177	14,484,083	16,807,085
Research, Development, Test, and Evaluation						
Military sciences	1,054,049	52,248	75,878	68,416	638,116	415,932
Aircraft	1,662,547	822,061	64,179	98,851	1,106,246	556,801
Missiles	2,501,864	158,217	109,482	138,197	1,890,572	610,782
Astronautics	875,158	61,514	51,567	47,288	598,262	276,895
Ships	359,289	11,716	15,646	15,751	271,507	87,782
Ordnance, vehicles, and related equipment	322,100	19,167	16,289	14,032	197,237	124,868
Other equipment	1,180,470	84,943	28,697	52,373	675,569	504,901
Program-wide management and support	676,870	49,229	41,811	45,625	435,590	241,280
Emergency fund	56,495	—	—	—	—	56,495
Undistributed	24,774	-977	-207	-269	-3,304	28,078
Total—Research, Development, Test, and Evaluation	8,718,105	758,118	403,296	475,259	5,809,794	2,908,311
Military Construction	3,125,617	78,951	154,430	201,282	1,032,661	2,092,956
Family Housing	689,917	59,015	95,162	33,588	384,636	305,281
Civil Defense	73,929	9,333	9,489	5,485	54,625	19,304
Other—Special Foreign Currency	15,162	50	37	271	742	14,419
Revolving and Management Funds	22,224,728	1,578,407	1,329,167	1,662,869	15,651,551	6,573,177
Offsetting receipts	-184,669	-82,327	-8,407	-8,484	-107,875	-26,794
Subtotal—Federal funds	113,001,710	8,217,656	6,710,160	7,625,759	74,040,356	38,961,354
Trust funds	79,854	5,502	3,725	2,604	44,743	35,110
Interfund transactions	-7,200	—	-2,049	-1	-4,662	-2,538
Total—Military Functions	113,074,364	8,223,157	6,711,836	7,628,364	74,080,438	38,993,926
Military Assistance						
Federal funds	420,145	85,022	7,339	51,968	284,747	135,399
Trust funds	1,983,792	31,544	13,812	5,533	8,494	1,975,298
Total—Military Assistance	2,403,937	116,566	21,151	57,501	293,241	2,110,696
TOTAL—DEPARTMENT OF DEFENSE	115,478,301	8,339,723	6,732,988	7,685,864	74,373,679	41,104,622

Department of the Army

Department of the Army	Available for obligation	Obligations Jan. 1970	Feb. 1970	Mar. 1970	Cum thru 31 Mar. 1970	Unobligated balance 31 Mar. 1970
Military Personnel						
Active forces	8,240,200	759,516	708,971	710,867	6,681,041	1,559,159
Reserve forces	665,400	46,157	45,414	51,563	500,832	164,568
Total—Military Personnel	8,905,600	805,672	754,385	762,430	7,181,879	1,723,727
Operation and Maintenance	8,532,137	695,457	599,189	704,014	6,310,569	2,221,568
Procurement						
Aircraft	810,672	8,930	21,162	74,936	292,560	518,112
Missiles	977,889	16,730	17,947	21,898	624,750	353,139
Tracked combat vehicles	322,194	24,259	13,807	16,259	184,189	138,005
Ordnance, vehicles and related equipment	4,180,897	180,623	198,267	127,227	2,406,339	1,774,558
Electronics and communications	782,486	43,783	15,485	10,679	171,630	610,856
Other procurement	968,730	40,463	32,525	165,237	387,591	581,139
Undistributed	153,942	1,425	193	308	−87	154,029
Total—Procurement	8,196,810	316,163	299,376	416,544	4,066,972	4,129,838
Research, Development, Test, and Evaluation						
Military sciences	184,763	10,800	8,645	10,307	130,539	54,224
Aircraft	138,708	1,617	9,312	6,198	52,948	85,760
Missiles	931,316	30,338	24,683	30,423	721,497	209,819
Astronautics	15,418	530	384	303	4,877	10,541
Ordnance, vehicles, and related equipment	205,517	6,899	7,488	10,362	107,124	98,393
Other equipment	474,427	18,174	23,082	24,109	241,714	232,713
Program-wide management and support	64,272	4,777	2,529	3,528	42,937	21,335
Undistributed	10,895	−20	−189	−43	−752	11,647
Total—Research, Development, Test, and Evaluation	2,025,316	73,115	75,934	135,187	1,300,884	724,432
Military Construction	1,386,408	34,490	60,935	175,704	544,751	841,657
Revolving and Management Funds	5,382,321	897,674	363,791	379,211	3,714,516	1,667,805
Applicable receipts	−67,611	−28,085	−4,360	−2,808	−59,178	−8,433
Subtotal—Federal Funds	34,360,981	2,294,486	2,155,260	2,570,282	23,060,387	11,300,594
Trust Funds	28,650	2,284	—	67	12,683	15,966
TOTAL—DEPARTMENT OF THE ARMY	34,389,632	2,296,769	2,155,252	2,570,348	23,073,070	11,316,561

Department of the Navy

Military Personnel						
Active forces	5,915,534	530,820	526,573	508,844	4,824,522	1,091,012
Reserve forces	176,570	13,532	14,435	15,716	133,534	43,036
Total—Military Personnel	6,092,104	544,352	541,007	524,561	4,958,056	1,134,049
Operation and Maintenance	6,321,977	672,361	378,452	440,457	4,790,998	1,530,979
Procurement						
Aircraft	2,818,669	242,693	97,305	135,795	1,102,791	1,715,878
Missiles	1,044,567	54,604	20,802	19,389	493,614	550,953
Ships	5,011,481	210,897	100,434	113,089	1,541,929	3,469,502
Tracked combat vehicles	45,332	378	7	10	17,063	28,269
Ordnance, vehicles and related equipment	1,387,265	140,993	67,120	101,728	838,159	549,106
Electronics and communications	588,291	39,086	21,087	29,509	277,378	310,913
Other procurement	1,491,580	51,384	60,397	80,320	777,819	713,761
Undistributed	−547,506	−1,250	−2,720	3,627	−3,086	−544,420
Total—Procurement	11,839,632	738,785	378,934	483,467	5,045,666	6,793,966
Research, Development, Test, and Evaluation						
Military sciences	145,380	12,158	10,402	7,708	106,771	38,609
Aircraft	850,022	221,258	18,877	42,737	640,450	209,572
Missiles	521,938	40,742	25,495	17,523	387,331	134,607
Astronautics	22,113	1,257	1,109	1,655	15,625	6,488
Ships	359,289	11,716	15,640	15,751	271,507	87,782
Ordnance, vehicles and related equipment	116,583	12,268	8,801	8,670	90,113	26,470
Other equipment	263,619	16,768	6,212	10,280	204,613	59,006
Program-wide management and support	282,749	31,076	−48	20,642	155,446	127,303
Undistributed	−5,613	−722	−142	−158	−2,157	−3,456
Total—Research, Development, Test, and Evaluation	2,556,080	356,111	86,442	119,803	1,875,699	680,381
Military Construction	1,212,206	38,059	78,081	7,262	395,460	816,757
Revolving and Management Funds	8,371,959	585,170	417,358	688,340	5,577,976	2,793,982
Applicable Receipts	−37,696	−3,265	−2,345	−2,572	−29,886	−7,810
Subtotal—Federal Funds	36,356,261	2,831,573	1,877,929	2,261,318	22,613,959	13,742,304
Trust Funds	16,252	1,447	1,142	884	9,724	6,528
Interfund Transactions	−7,200	—	−2,049	−1	−4,662	−2,538
TOTAL—DEPARTMENT OF THE NAVY	36,365,313	2,833,022	1,877,021	2,262,160	22,619,020	13,746,294

Department of the Air Force

Department of the Air Force	Available for obligation	Obligations Jan. 1970	Obligations Feb. 1970	Obligations Mar. 1970	Cum thru 31 Mar. 1970	Unobligated balance 31 Mar. 1970
Military Personnel						
Active forces	5,865,300	527,448	522,123	526,729	4,837,948	1,027,352
Reserve forces	178,635	11,923	13,479	13,800	134,621	44,014
Total—Military Personnel	6,043,935	539,370	535,603	540,530	4,972,570	1,071,315
Operation and Maintenance	7,214,851	705,409	480,561	508,830	5,496,286	1,718,565
Procurement						
Aircraft	6,450,712	383,416	202,887	327,849	2,623,009	3,827,702
Missiles	2,080,613	68,358	176,297	91,179	1,162,867	917,746
Ordnance, vehicles and related equipment	1,261,604	33,498	31,879	56,858	859,717	401,887
Electronics and communications	822,860	21,714	34,097	31,519	319,494	503,366
Other procurement	492,628	42,360	35,872	9,916	339,415	153,213
Undistributed	10,217	212	797	−32	1,431	8,786
Total—Procurement	11,118,633	499,549	481,328	517,290	5,305,933	5,812,700
Research, Development, Test, and Evaluation						
Military sciences	178,614	5,709	18,815	9,925	114,814	63,800
Aircraft	673,817	99,186	35,990	49,916	406,848	266,969
Missiles	1,048,100	73,137	59,254	40,251	781,744	266,356
Astronautics	837,627	59,727	49,984	45,331	577,761	259,866
Other equipment	442,424	50,011	−597	17,984	229,242	213,182
Program-wide management and support	329,849	12,776	39,330	21,455	237,207	92,642
Undistributed	19,492	−235	124	−68	−395	19,887
Total—Research, Development, Test, and Evaluation	3,529,928	300,311	202,903	184,789	2,347,219	1,182,703
Military Construction	463,445	5,897	8,914	18,260	89,690	373,755
Revolving and Management Funds	4,869,140	411,656	345,915	382,125	4,262,742	606,398
Offsetting Receipts	−29,323	−976	−1,699	−3,054	−18,772	−10,551
Subtotal—Federal Funds	33,210,604	2,461,216	2,053,525	2,148,770	22,455,668	10,754,935
Trust Funds	34,952	1,771	2,582	1,703	22,336	12,616
TOTAL—DEPARTMENT OF THE AIR FORCE	33,245,556	2,462,986	2,056,107	2,150,474	22,478,004	10,767,552

Defense Agencies/Office of the Secretary of Defense

Operation and Maintenance	1,112,488	99,967	87,281	97,975	887,039	225,444
Procurement						
Ordnance, vehicles and related equipment	675	95	39	47	564	111
Electronics and communications	9,115	452	546	64	2,514	6,601
Other procurement	124,788	6,016	4,361	9,764	62,434	62,354
Undistributed	1,516	—	—	—	—	1,516
Total—Procurement	136,094	6,563	4,946	9,875	65,512	70,581
Research, Development, Test, and Evaluation						
Military sciences	545,292	23,581	38,016	35,481	285,992	259,299
Undistributed	—	—	—	—	—	—
Total—Research, Development, Test, and Evaluation	545,292	23,581	38,016	35,481	285,992	259,299
Military Construction	63,557	503	500	57	2,770	60,787
Revolving and Management Funds	3,601,308	183,908	196,102	213,194	2,096,317	1,504,991
Offsetting Receipts	−39	−1	−3	—	−39	—
Subtotal—Federal Funds	5,458,694	314,523	326,841	355,983	3,337,592	2,121,102
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	5,458,694	314,523	326,841	355,983	3,337,592	2,121,102

Defense-Wide

Retired Military Personnel						
Retired Pay, Defense	2,786,000	244,361	248,671	246,556	2,103,431	631,569
Operation and Maintenance	44,666	3,100	3,254	3,509	29,317	15,349
Research, Development, Test, and Evaluation						
Emergency Fund, Defense	56,495	—	—	—	—	56,495
Family Housing	689,917	59,015	36,162	33,588	384,636	305,281
Other—Special Foreign Currency Program	15,162	50	37	271	742	14,419
TOTAL—DEFENSE-WIDE	3,541,240	306,525	287,126	283,923	2,518,126	1,023,113

Office of Civil Defense

Civil Defense	73,929	9,333	9,489	5,485	54,625	19,304

Military Assistance

Federal Funds	420,145	85,022	7,839	51,968	284,747	135,399
Trust Funds	1,988,792	31,544	13,812	5,533	8,494	1,975,298
TOTAL—MILITARY ASSISTANCE	2,403,937	116,566	21,151	57,501	293,241	2,110,696

NOTE: All outlay amounts are on a net Treasury basis (gross payments less reimbursement collections), whereas obligations and unpaid obligations are on a gross basis (inclusive of reimbursable activity performed by components of DOD for each other). Therefore, unpaid obligations as of the end of the reporting month cannot be computed from other figures in this report.

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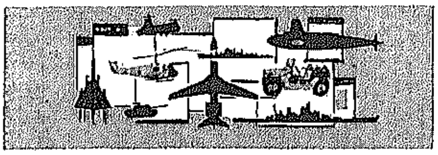

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of May 1970.

DEFENSE SUPPLY AGENCY

5—Applied Technology Div., AVCO Corp., Lowell, Mass. $1,261,027. Body armor for aircrews, and small arms protective carriers. Golden, Colo., Garnerville, N.Y., and Lowell. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1740.

—Tesoro Petroleum Corp., San Antonio, Tex. $1,257,798. Various quantities of gasoline and fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1452.

12—Esso International, Inc., New York, N.Y. $1,680,250. 715,000 barrels of Navy distillate. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-0899.

22—Steuart Petroleum Co., Washington, D.C. $6,635,003. 89,890,000 gallons of No. 6 fuel oil for federal agencies in the Washington, D.C., area. Defense Fuel Supply Center, Alexandria, Va. DSA-600-70-D-1975.

25—Lester D. Lawson and Co., Long Beach, Calif. $1,822,652. 64,656 cases of ration supplement sundries pack. Modesto, Calif. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-70-C-S501.

—United States Steel International, Inc., New York, N.Y. $1,087,755. 1,500,000 72-inch fense posts. Provo, Utah. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-D-0010.

26—Kaiser Steel Corp., El Monte, Calif. $1,335,760. 1,200,000 32-inch fence posts and 800,000 96-inch fence posts. Fontana and Peco Rivera, Calif. Defense Construction Supply Center, Columbus, Ohio. DSA 700-69-D-0050.

28—Texaco, Inc., Long Island City, N.Y. $1,622,167. Lubricants for military and civilian agencies. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1017.

DEPARTMENT OF THE ARMY

1—H. B. Zachery Co., San Antonio, Tex. $9,534,811. Work on the Lavon Dam and Reservoir, East Fork Trinity River, Collin County, Tex. Army Engineer District, Fort Worth, Tex. DA-CW63-70-C-0047.

—American Dredging Co., Philadelphia, Pa. $1,557,888. Removal and disposal of all dredge material in Newark Bay, N.J. Army Engineer District, New York, N.Y. DA-CW51-70-C-0033.

—Perini Corp., San Francisco, Calif. $3,495,791. Construction of the main dam and appurtenances, Mardis Creek Reservoir Project, Nevada County, Nev. Army Engineer District, Sacramento, Calif. DA-CW05-70-C-0089.

—Bauer Dredging Co., Inc., Port Lavaca, Tex. $1,986,400. Construction and appurtenance work on the Lake Pontchartrain Hurricane Protection Project, Orleans and St. Bernard Parishes, La. Army Engineer District, New Orleans, La. DA-CW29-70-C-0203.

—White Motor Corp., Lansing, Mich. $2,712,845. Engineering services for M44 and M602 series trucks. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-3359.

—Allis Chalmers Manufacturing Co., York, Pa. $3,886,100. Four 165,000 HP hydraulic turbines for the Libby Reservoir Project, Mont. Army Engineer District, Seattle, Wash. DA-CW67-70-C-0058.

—Williams-McWilliams Co., New Orleans, La. $1,117,477. Rental of one 24-inch hydraulic dredge for work on the Greenville and Vicksburg Channels of the Mississippi River. Army Engineer District, Vicksburg, Miss. DA-CW38-70-C-0124.

—Control Data Corp., Minneapolis, Minn. $3,891,939 (contract modification). Automatic data processing equipment. Safeguard System Command, Huntsville, Ala. DA-HC60-69-C-0017.

4—Magline, Inc., Pinconning, Mich. $1,131,210 (contract modification). Electrical equipment shelters, S-208/G. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-69-C-0114.

—The Melbourne Construction Co., Canton, Ohio. $3,826,000. Construction of an operating tower, discharge conduit, stilling basin, service bridge and appurtenant work, East Fork Reservoir-Little Miami River Project, Ohio. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0092.

5—McGinnes Brothers, Houston, Tex. $1,623,176. Construction of a levee for the Port Arthur Hurricane-Flood Protection Project, Port Acres, Tex. Army Engineer District, Galveston, Tex. DA-CW64-70-C-0069.

—Watson Construction Co., Minneapolis, Minn. $3,369,850. Construction of Phase I Safeguard site radar facilities, 8 miles east of Conrad, Mont. Army Engineer District, Huntsville, Ala. DA-CA87-70-C-0017.

—Honeywell, Inc., Hopkins, Minn. $3,491,000 (contract modification). Classified development work. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0096.

—Goodyear Tire and Rubber Co., Akron, Ohio. $1,576,277. T130 track assemblies for M113 personnel carriers. St. Mary's, Ohio. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-4152.

—Penner Construction Co., Denver, Colo. $2,569,560. Design and construction of a field maintenance hanger, including all utilities and site work, Altus AFB, Okla. Army Engineer District, Fort Worth, Tex. DA-CA63-70-C-0052.

—Olin Corp., East Alton, Ill. $6,662,000. Propellants. St. Marks, Fla., and East Alton. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0613.

6—Motorola, Inc., Scottsdale, Ariz. $1,000,000. Classified electronics equipment. Army Electronics Command, Fort Monmouth, N.J.

—Pitts Manufacturing Corp., Memphis, Tenn. $1,093,655. Type G plugs for 155mm, 175mm and 8-inch shells. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0390.

—AVCO Corp., Charleston, S.C. $1,106,000. Overhaul and/or repair of T-53-13/13A turbine engines for UH-1H or AH-1G helicopters. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-A-0308.

7—Jensen Construction Co., Des Moines, Iowa. $2,878,821. Construction work at the Saylorville Reservoir Project, Des Moines River, Iowa. Polk County, Iowa, Army Engineer District, Rock Island, Ill. DA-CW25-70-C-0068.

—Buckley Construction Co., Inc., Fenton, Mo. $1,923,733. Construction of recreation facilities, Shelbyville Reservoir Project, Kaskaskia River, Ill. Moultrie County, Ill. Army Engineer District, St. Louis, Mo. DA-CW43-70-C-0181.

—Eugene Luhr and Co., Columbia, Ill. $3,952,767. Construction of substitute railroad facilities, bridge and tracks, Kaskaskia River Navigation Project, Randolph County, Ill. Army Engineer District, St. Louis, Mo. DA-CW43-70-C-0186.

8—Tyee Construction Co., Bellevue, Wash. $2,526,000. Clearing 5,600 acres of the Dworshak Reservoir Project, north fork of the Clearwater River, Clearwater County, Idaho. Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0089.

—Bell Helicopter Co., Hurst, Tex. $1,680,970. Advance development feasibility type helicopter with (HELMS) multi-function systems installed and flight tested in two HU-1C/M helicopters. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0149.

12—Markham and Brown, Inc., Dallas, Tex. $1,173,090. Construction of a stone flood control dike on the Mississippi River and Tributaries channel improvement project, Chicot County, Ark. Army Engineer District, Vicksburg, Miss. DA-CW38-70-C-0129.

—Standard Dredging Corp., New York, N.Y. $2,649,055. Dredging and construction work on the Savannah Harbor Project, Ga. Army Engineer District, Savannah, Ga. DA-CW21-70-C-0045.

—Bell Helicopter Co., Fort Worth, Tex. $3,436,031 (contract modification). UH-1H utility helicopters. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0666.

13—Guy F. Atkinson Co., Dravo Corp., Arundel Corp., and L. E. Dixon Co. (joint venture), San Francisco, Calif. $105,202,657. Construction of the main dam and appurtenant works, Lower Granite Lock and Dam, Snake River Project, Garfield and Whitman Counties, Wash. Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0088.

—Oneglia and Gervasini Construction Co., Inc., Torrington, Conn. $5,843,882. Construction of levees and flood walls, pumping station and appurtenant works for the Local Flood Protection Project, Derby, Conn. New Haven, Conn. New England Army Engineer Division, Waltham, Mass. DA-CW33-70-C-0147.

—General Motors Corp., Indianapolis, Ind. $3,488,949 (contract modification). Service research and development, and interim advanced production engineering effort on the MBT-70/XM803 Main Battle Tank, Milwaukee, Wis., Cleveland, Ohio, Muskegon, Mich., Indianapolis and other locations. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-5272.

14—General Electric Co., Burlington, Vt. $1,448,991 (contract modification). 20mm automatic guns, M61A1. Army Procurement Agency, New York, N.Y. DA-AG25-70-C-0204.

—Standard Dredging Corp., New Orleans, La. $1,157,085. Rental of a hydraulic pipe line dredge and attendant plant for 154 days. Army Engineer District, Memphis, Tenn. DA-CW66-70-C-0107.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

15—**Raytheon Co.,** Andover, Mass. $2,175,000 (contract modification). Engineering services for the improved Hawk missile system. Bedford and Andover, Mass., and White Sands Missile Range, N.M. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0195.

—**Wiley N. Jackson Co.,** Salem, Va. $4,498,403. Construction and excavation work on the Central and Southern Florida Flood Control Project, Osceola County, Fla. Army Engineer District, Jacksonville, Fla. DA-CW17-70-C-0069.

—**Dixie Bridge Co., Inc.,** Lexington, Ky. $1,432,434. Construction work at the R. D. Bailey Lake Project, Wyoming County, W. Va. Army Engineer District, Huntington, W. Va. DA-CW-70-C-0055.

—**Korshoj Construction Co., Inc.,** Blair, Neb. $1,437,410. Work on the Flood Protection—Blue River Federal Complex Project, Jackson County, Mo. Army Engineer District, Kansas City, Mo. DA-CW41-70-C-0091.

—**Texas Instrument, Inc.,** Dallas, Tex. $3,540,540. AN/AAS-24 detecting sets, test equipment and ancillary items for the Mohawk OV-1D aircraft. Procurement Division, Army Electronics Command, Fort Monmouth, N.J. DA-AB07-69-C-0257.

18—**Gates and Fox Co., Inc., Manson-Osberg, Co.,** and **Constructors-Panco** (joint venture), Loomis, Calif. $19,844,730. Construction of hydroelectric facilities, including installation of government furnished equipment, at the Snettisham Project, Juneau, Alaska. Army Engineer District, Anchorage, Alaska. DA-CW85-70-C-0020.

19—**H. C. Smith and Amelco Corp.** (joint venture), Compton, Calif. $4,773,402. Construction of Safeguard Perimeter Acquisition Radar Facilities, Phase I, Toole County, Mont. Army Engineer Division, Huntsville, Ala. DA-CA87-70-C-0020.

—**The Boeing Co.,** Ridley Park, Pa. $1,186,000. Technical manuals, publications and work requirement for support of CH-47 helicopters. Morton, Pa. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0524.

—**Weiss Construction Co.,** Brandon, Fla. $1,722,450. Construction and appurtenant work, Central and Southern Florida Flood Control Project, Osceola County, Fla. Army Engineer District, Jacsonville, Fla. DA-CW17-70-C-0073.

20—**Martin Marietta Corp.,** Orlando, Fla. $1,124,411. TD-660/G multiplexers. Ocala, Fla. Procurement Division, Army Electronics Command, Fort Monmouth, N.J. DA-AB05-70-C-4116.

—**RCA,** Burlington, Mass. $1,017,076. Land Combat Support System equipment. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0845.

—**Dickerson, Inc.,** Monroe, N.C. $2,503,198. Relocation work of 20 miles of Norfolk-Southern Railway, New Hope Reservoir, New Hope, N.C. Wake, Chatham and Durham Counties, N.C. Army Engineer District, Wilmington, N.C. DA-CW54-70-C-0031.

—**Gust K. Newburg Construction Co.,** Chicago, Ill. $34,497,000. Construction of dam and appurtenance works, and removal of existing lock and dams 48 and 49, Uniontown Lock and Dam Project, Ohio River, Posey County, Ind., and Union County, Ky. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0105.

21—**Peter Kiewit Sons, Inc.,** Omaha, Neb. $1,989,000. Construction of an extension to the southeast runway, Offutt AFB, Neb. Army Engineer District, Omaha, Neb. DA-CA45-70-C-0077.

—**Winston Brothers Co. and Foley Brothers, Inc.** (joint venture), Minneapolis, Minn. $1,908,639. Excavation for the main dam, outlet conduit and access road, Ririe Reservoir, Willow Creek Project, Idaho. Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0094.

—**LTV Electrosystems, Inc.,** Huntington, Ind. $7,165,108. AN/VRC-12 compact lightweight vehicular radio set components. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-67-C-0171.

22—**Herlo Engineering Corp.,** Hawthorne, Calif. $1,538,606. M1 and M2 carbine barrel assemblies. Hawthorne and Long Beach, Calif. Army Weapons Command, Rock Island, Ill. DA-AF01-70-C-0827.

—**Gerbus Brothers Construction Co.,** Cincinnati, Ohio. $1,593,690. Construction of roads, culverts and bridges at six separate sites near the Paint Creek Dam, Highland and Ross Counties, Ohio. Army Engineer District, Huntington, W. Va. DA-CW69-70-C-0053.

—**Maro, Inc.,** Warren, Ark. $1,358,186. Road relocation work and construction of a bridge, DeQueen Reservoir, Rolling Fork River Project, Sevier County, Ark. Army Engineer District, Tulsa, Okla. DA-CW56-70-C-0131.

—**AVCO Corp.,** Charleston, S.C. $2,940,000. Overhaul and/or repair of T-53-L-13 engines for UH-1H and AH-1G aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-A-0308.

—**Western Electric Co.,** New York, N.Y. $5,411,250 (contract modification). Studies for the improved Spartan missile for the Safeguard Ballistic Missile Defense System. McDonnell-Douglas Corp., Santa Monica, Calif., and Bell Telephone Labs, Whippany, N.J. Safeguard System Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

—**Structures, Inc.,** Greenville, S.C. $2,999,263. Structure removal work and construction of a superstructure on the Cross Florida Barge Canal Project, Marion County, Fla. Army Engineer District, Jacksonville, Fla. DA-CW17-70-C-0076.

25—**Bauer Dredging Co., Inc.,** Port Lavaca, Tex. $1,029,800. Maintenance dredging at the Mississippi River Gulf Outlet Project, Plaquemines Parish, La. Army Engineer District, New Orleans, La. DA-CW29-70-C-0228.

—**Union Carbide Corp.,** New York, N.Y. $2,530,565. Type BA-4386/PRC-25 dry batteries, production testing, and engineering and first article samples. Charlotte, N.C. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-70-C-1472.

26—**Western Electric Co.,** New York, N.Y. $2,175,114 (contract modification). Command and control equipment for Safeguard system Missile Site Radar tactical control site. Allentown, Pa. and Lexington, Mass. Safeguard System Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

—**Great Lakes Dredge & Dock Co.,** New York, N.Y. $15,470,000. Deepening and widening of channels and basins at the Fore and Town River, Weymouth, Mass., Project. Weymouth, Hull, Hingham and Quincy, Mass. Army Engineers New England Division, Waltham, Mass. DA-CW-33-70-C-0155.

—**Bohemia Lumber Co.,** Eugene, Ore. $5,973,870. Construction on south jetty at the Yaquina Bay, Harbor, and River Project. Lincoln County, Ore. Army Engineers District, Portland, Ore. DA-CW-50-70-C-0125.

28—The Army Procurement and Supply Agency, Joliet, Ill., has issued the following contract modifications:

Day & Zimmerman, Inc., Philadelphia, Pa. $3,786,592. Loading, assembling and packing ammunition, and operating Army Ammunition Plant, Parsons, Kan. DA-AA-09-70-C-0245.

Day & Zimmerman, Inc., Philadelphia, Pa. $13,366,298. Loading, assembling and packing ammunition, and operating Lone Star Army Ammunition Plant, Texarkana, Tex. DA-11-173-AMC-114 (A).

Uniroyal, Inc., New York, N. Y. $6,662,274. Operation of Joliet Army Ammunition Plant, and loading, assembling and packing of ammunition and related components. DA 11-173-AMC-62 (A).

Olin Corp., Stamford, Conn. $1,920,641. Loading, assembling and packing propellant charges, and operating Indiana Army Ammunition Plant, Charlestown, Ind. DA-AA09-69-C-0148.

Olin Corp., Stamford, Conn. $6,406,323. Loading, assembling and packing ammunition, and operation of Badger Army Ammunition Plant, Baraboo, Wis. DA-AA09-69-C-0014.

Thiokol Chemical Corp., Bristol, Pa. $3,309,924. Loading, assembling and packing ammunition, and operating Long Horn Army Ammunition Plant, Marshall, Tex. DA 11-172-AMC-200 (A).

Harvey Aluminum Sales, Inc., Torrance, Calif. $3,665,836. Loading, assembling and packing ammunition, and operating Army Ammunition Plant, Milan, Tenn. DA 11-173-AMC-520 (A).

Atlas Chemical Industries, Inc., Wilmington, Del. $10,333,752. Plant maintenance and operation of the Volunteer Army Ammunition Plant, Chattanooga, Tenn. DA-11-173-AMC-00531.

Sperry Rand Corp., New York, N. Y. $24,367,566. Loading, assembling and packing ammunition, and operating Army Ammunition Plant, Shreveport, La. DA-11-173-AMC-00080 (A).

E. I. DuPont de Nemours & Co., Inc., Wilmington, Del. $2,009,601. Pre-operation activities in support of TNT production and operating Army Ammunition Plant, Newport, Ind. DA-AA09-68-C-0414.

Eastman Kodak Co., Kingsport, Tenn. $8,611,094. Production of explosives and support services, and operation of Holston Army Ammunition Plant, Kingsport. DA-11-173-AMC-0035 (A).

Hercules, Inc., Wilmington, Del. $16,033,401. Rocket propellant production and operation of Sunflower Army Ammunition Plant, Lawrence, Kan. DA-11-173-AMC-00042 (A).

DVA Corp., Mount Laurel, N.J. $1,475,761. Metal parts for M125A1 boosters. DA-AA09-70-C-0195.

Etowah Manufacturing Co., Inc., Gadsden, Ala. $1,469,850. Metal parts for M125A1 boosters. DA-AA09-70-C-0196.

Chamberlain Manufacturing Corp., New Bedford, Mass. $2,444,040. Metal parts for 155mm projectiles (M107). DA-AA09-70-C-0075.

—**General Motors Corp.,** Indianapolis, Ind. $12,712,577 (contract modification). Research and development and interim advance production engineering effort on MBT-70/XM803 Main Battle Tank. Milwaukee, Wis.; Cleveland, Ohio; Kalamazoo, Mich.; Muskegon, Mich.; Indianapolis and other locations. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-5272.

—**Walter Toebe & Co., and Sugden, Inc.,** (joint venture), Wixon, Mich. $11,565,036. Construction of Section A at River Rouge Flood Control Project. Wayne County, Mich. Army Engineers District, Detroit, Mich. DA-CW35-70-C-0041.

—**Allied Products,** Denton, Tex. $1,167,407. Two-wheeled trailer chassis (M353). Curtis Field, Brady, Tex. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-4622.

—**Baldwin Electronics, Inc.,** Little Rock, Ark. $1,000,080. Loading, assembling and packing motors for 2.75-inch rockets. Camden, Ark. Picatinny Arsenal, Dover, N. J. DA-AA21-70-C-0300.

—**Anderson Construction Co., Inc.,** Holton, Kan. $1,672,787. Construction of outlet works on Optima Dam, North Canadian River, Okla., Project. Texas County, Okla. Army Engineers District, Tulsa, Okla. DA-CW-56-70-C-0143.

—**Sanford Construction Co.,** Cleveland, Ohio. $1,591,480. Construction of repair shop, ambulance garage, and additions to existing buildings at Army Ammunition Plant, Ravenna, Ohio. Army Engineers District, Louisville, Ky. DA-CA27-70-C-0033.

—**Allis-Chalmers Manufacturing Co.,** Milwaukee, Wis. $1,502,123. Electric fork-lift trucks. Matteson, Ill. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-6842.

—**Lueder Construction Co.,** Omaha, Neb. $1,813,852. Design and construction of 100 family housing units at Fort Leavenworth, Kan. Army Engineers District, Kansas City, Mo. DA-CA41-70-C-0047.

—**Campanella Corp.,** Warwick, R. I. $4,196,500. Construction of breakwater in vicinity of Provincetown, Mass. Army Engineers New England Div., Waltham, Mass. DA-CW33-70-C-0156.

DEPARTMENT OF THE NAVY

4—**Grumman Aerospace Corp.**, Bethpage, N.Y. $6,800,000 (contract modification). F-14A maintenance trainer. Bethpage and Calverton, N.Y. Naval Air Systems Command, Washington, D.C. N00019-69-C-0422.

—**Raytheon Co.**, Lexington, Mass. $5,874,010 (contract modification). Sparrow missile guidance and control sections for the Navy and Air Force. Lowell and Bedford, Mass., and Bristol and Oxnard, Tenn. Naval Air Systems Command, Washington, D.C. N00019-69-C-0358.

—**Howard Construction Co., Inc.**, Greensboro, N.C. $4,832,000. Construction of a sanitary and industrial sewer system, Charleston, S.C., Naval Base. Naval Facilities Engineering Command, Washington, D.C. N62467-67-C-0344.

—**General Dynamics Corp.**, Groton, Conn. $1,426,086 (contract modification). Engineering, planning and design services in support of conventional and nuclear submarine noise reduction program. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0239 P005.

—**Welex Electronics Div., Halliburton Co.**, Silver Spring, Md. $1,151,320. Services in support of the AN/BQQ-1, -2 and -3, and AN/BQS-11, -12 and -13 sonor systems. Naval Regional Procurement Office, Brooklyn, N.Y. N00140-70-D-0520.

5—**Raytheon Co.**, Portsmouth, R.I. $3,907,354 (contract modification). Three AN/BQS-11/12 submarine sonar range detection units. Naval Ship Systems Command, Washington, D.C. NObsr 95304 Mod 19.

—**General Motors Corp.**, Goleta, Calif. $1,-550,000. Mk 107 Mod 0 warheads and associated equipment for use with Mk 48 Mod 1 torpedoes. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1302.

6—**Johns Hopkins University**, Silver Spring, Md. $4,061,400 (contract modification). Advanced research on the surface missile system. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604.

—**United Aircraft Corp**, East Hartford, Conn. $2,861,408 (contract modification). TF-30-P-412 engines. Naval Air Systems Command, Washington, D.C. N00019-70-C-0208.

—**Magnavox Co.**, Fort Wayne, Ind. $1,889,-000. Set up test and repair facility at Magnavox for AQA7 DIFAR in P-3 aircraft. Navy Aviation Supply Office, Philadelphia, Pa. N00383-70-A-0901-0066.

—**Republic Electronic Industries Corp.**, Melville, N.Y. $1,810,331. AN/ARV-52(V) navigational sets. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-C-3436.

7—**Rohr Corp.**, Chula Vista, Calif. $9,564,434. 61 mechanized landing craft, LCM-8. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0292.

—**Kaman Aircraft Corp.**, Bloomfield, Conn. $3,500,000 (contract modification). Long lead-time items for conversion of UH-2A/B helicopters to HH-2D configuration. Naval Air Systems Command, Washington, D.C. N00019-70-C-0051.

8—**Admiral Systems Corp.**, Chicago, Ill. $3,-728,495. AN/ARC-51 aircraft radio sets. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-C-3484.

—**McDonnell Douglas Corp.**, Long Beach, Calif. $2,807,000 (contract modification). Long lead-time items for TA-4J and A-4M aircraft. Naval Air Systems Command, Washington, D.C. N00019-67-C-0170.

—**LTV Aerospace Corp.**, Dallas, Tex. $1,600,-000 (contract modification). Development of interface between A-7 aircraft avionics and VAST system. Naval Air Systems Command, Washington, D.C. N00019-69-C-0586.

11—**Norris Industries**, Los Angeles, Calif. $13,-706,405. Mk 81 Mod 1 bomb bodies, Vernon, Calif. Naval Ship Parts Control Center, Mechanicsburg, Pa. N00104-70-CA-139.

—**Dynell Electronics Corp.**, Melville, N.Y. $1,753,937. Development of Navy submarine acoustic-warfare intercept receiver system. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1283.

—**Daniel and House Construction Co.**, Monterey, Calif. $1,581,855. Construction of a library facility, Naval Postgraduate School, Monterey. Naval Facilities Engineering Command, Washington, D.C. N62474-69-C-0156.

—**LTV Aerospace Corp.**, Dallas, Tex. $19,-040,000 (contract modification). Long lead time items for Navy A-7E aircraft. $5,447,-863 (contract modification). Long lead time for A-7D aircraft for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-68-C-0075 and N00019-67-C-0143.

12—**IBM Corp.**, Owego, N.Y. $54,421,485. AN/BQS submarine sonar systems. Naval Shop Systems Command, Washington, D.C. N00024-70-C-1300.

—**Lasko Metal Products, Inc.**, West Chester, Pa. $1,374,600. Snakeye bomb fins, Mk 15 Mod 2. Naval Ship Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A150.

—**United Aircraft Corp.**, Hartford, Conn. $39,021,603. Product support engineering services for TF-30 series engine for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-0209.

—**Raytheon Co.**, Goleta, Calif. $2,780,172. AN/ALQ-76 transmitters and ancillary items. Naval Air Systems Command, Washington, D.C. N00019-70-C-0527.

—**Hughes Aircraft Co.**, Culver City, Calif. $2,600,000 (contract modification). Incremental funding for Phoenix missiles. Naval Air Systems Command, Washington, D.C. N00019-67-C-0240.

—**Texas Instruments, Inc.**, Dallas, Tex. $1,-390,244. AN/ASQ-81 magnetic detecting sets. Naval Air Systems Command, Washington, D.C. N00019-70-C-0433.

13—**Lockheed Aircraft Corp.**, Burbank, Calif. $2,500,000 (contract modification). Long lead time items to support procurement of RP-3D aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0237.

—**Hughes Aircraft Co.**, Fullerton, Calif. $2,-532,843. AN/SPS-52 radars and peripheral equipment. N00024-70-C-1346. $3,701,466 (contract modification). AN/SPS-33 shipboard radar equipment modernization. N00024-69-C-1244. Naval Ship Systems Command, Washington, D.C.

14—**Lockheed, Missile and Space Co.**, Sunnyvale, Calif. $1,395,000. Continued research and development work in deep submergence vehicle technology. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0254.

—**PRD Electronics, Inc.**, Jericho, N.Y. $1,-494,219 (contract modification). AN/USM-247 avionics test stations for A-7E aircraft. Naval Air Systems Command, Washington, D.C. N00019-60-C-0334.

—**Coronis Construction Co.**, Winchester, Mass. $1,875,000. Construction of 100 family housing units, Naval Air Station, Quonset Point, R.I. Naval Facilities Engineering Command, Washington, D.C. N62464-69-C-0219.

15—**Fedrick-Sundt** (joint venture), Novato, Calif. $1,641,251. Construction of an industrial waste system, Naval Shipyard, Mare Island, Calif. Naval Facilities Engineering Command, Washington, D.C. N62474-69-C-0160.

18—**Northrop Carolina Inc.**, Asheville, N.C. $3,223,461. Aircraft parachute flares, Mk 24 Mod 4. Swannanoa, N.C. Naval Ship Part Control Center, Mechanicsburg, Pa. N00104-70-C-A069.

—**Ingalls Shipbuilding Div., Litton Systems**, Pascagoula, Miss. $2,967,242. Advanced planning, design and material procurement for the overhaul of the USS Greenling, SSN-614. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0280.

—**General Dynamics Corp.**, Groton, Conn. $1,824,047 (contract modification). Engineering and planning yard services for operational fleet ballistic missile submarines. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0240 P007.

—**FMC Corp.**, Fridley, Minn. $1,290,000. Preparation of documentation for the 5-inch 54 caliber Mk 42 Mod 10 gunmount. Naval Ordnance Station, Louisville, Ky. N00197-70-C-0168.

19—**PRD Electronics, Inc.**, Syosset, N.Y. $2,-814,332. Services and materials for the VAST (Versatile Avionics Shop Test) program. Naval Air Systems Command, Washington, D.C. N00019-68-C-0449.

—**Hughes Aircraft Co.**, Los Angeles, Calif. $2,417,002. Design data and long lead time items for a 15C9 missile control officer trainer for the F-14A aircraft. Naval Training Device Center, Orlando, Fla. N61339-70-C-0255.

—**Marquardt Co.**, Ogden, Utah. $2,072,023. Aerial tow target launchers. Naval Air Systems Command, Washington, D.C. N00019-70-C-0538.

—**Litton Systems, Inc.**, Van Nuys, Calif. $1,500,000. Studies, modification kits, and installation, and supporting data for the Tactical Air Operations Center, AN/TYQ-2. Headquarters, Marine Corps, Washington, D.C. M00027-70-C-0137.

20—**Lockheed Aircraft Corp.** Sunnyvale, Calif. $198,056,279. Poseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0092.

—**Hughes Aircraft Co.**, Culver City, Calif. $13,300,000 (contract modification). AN/AWG-9 airborne missile control systems. Tucson, Ariz., and Canoga Park, Culver City, Los Angeles and El Segundo, Calif. Naval Air Systems Command, Washington, D.C. N00019-70-C-0207.

—**Lockheed Aircraft Corp.**, Marietta, Ga. $3,446,967 (contract modification). Progressive aircraft rework on C-130s. Naval Air Systems Command, Washington, D.C. N00019-70-C-0153.

—**General Dynamics Corp.**, Groton, Conn. $1,769,191. Engineering and design services in support of the C-3 Poseidon weapon system development on the SSBN class conversion program. Naval Ship Systems Command, Washington, D.C. N00024-70-C-2085.

21—**Univac Div., Sperry Rand Corp.**, St. Paul, Minn. $5,510,000. Mk 152 Mods 1, 2 and 3 digital computers and associated ancillary equipment for modernization of Tartar and Talos fire control systems. Naval Ordnance Systems Command, Washington, D.C. N00017-69-C-2326.

—**Ingalls Shipbuilding Div., Litton Systems, Inc.**, Pascagoula, Miss. $4,950,000 (contract modification). Overhaul of the USS Darter (SS-576). Naval Ship Systems Command, Washington, D.C. N00024-69-C-0282.

—**Curtiss-Wright Corp.**, Wood Ridge, N.J. $2,828,032. Cylinder assemblies for R-1820-80/82/84/86 aircraft engines. Naval Aviation Supply Office, Philadelphia, Pa. F41608-69-A-0057-GBJC.

—**McDonnell Douglas Corp.**, St. Louis, Mo. $1,184,000 (contract modification). F-4E and RF-4C aircraft for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-69-C-0521.

—**Texas Instruments, Inc.**, Dallas, Tex. $1,-107,819. Design and fabrication of guidance and control components and subassemblies for the Extended Guided Projectile Program. Naval Weapons Laboratory, Dahlgren, Va. N00178-70-C-0182.

—**IBM Corp.**, Owego, N.Y. $1,129,866. Line items for A-6A aircraft navigational instrument subassemblies. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-A-4401-0016.

—**FMC Corp.**, Minneapolis, Minn. $1,018,122. Replacement parts for Mk 42 Mod 9 5-inch 54 caliber gun mounts. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-A-0093.

22—**Univac Div., Sperry Rand Corp.**, St. Paul, Minn. $1,493,948. 642B computers, spare parts and engineering services. Salt Lake City, Utah, and St. Paul. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1213.

—**Honeywell, Inc.**, Minneapolis, Minn. $1,-493,892. Air munitions. Naval Air Systems Command, Washington, D.C. N00019-70-C-0176.

26—**General Electric Co.**, W. Lynn, Mass. $2,429,430. Retrofit kits for T58-GE8 helicopter engines. Naval Aviation Supply

Office, Philadelphia, Pa. F34601-70-A-0962-GB07.

—Singer-General Precision, Inc., Little Falls, N.J. $1,452,000. Materials for test sets for aircraft radars. Naval Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3201-0321.

—Grumman Aerospace Corp., Bethpage, N.Y. $3,000,000 (contract modification). Conversion of A-6A aircraft to a KA-6D configuration. Stuart, Fla., and Bethpage. Naval Air Systems Command, Washington, D.C. N00019-70-C-0458.

—Lockheed Missiles Space Co., Sunnyvale, Calif. $1,931,964. Fleet Ballistic Missile reentry studies and analyses. Navy Strategic Systems Project Office, Washington, D.C. N00030-70-C-0165.

—C. W. Matthews Contracting Co., Inc., Marietta, Ga. $1,327,500. Construction of aircraft parking apron and hydrant fueling at Charleston AFB, S.C. Naval Facilities Engineering Command, Washington, D.C. N62467-69-C-0198.

—Leon H. Perlin Co., Inc., Newport News, Va. $1,421,000. Construction of guided missile maintenance facility at Naval Weapons Station, Yorktown, Va. Naval Facilities Engineering Command, Washington, D.C. N62470-70-C-0880.

27—PRD Electronics, Inc., Syosset, N.Y. $6,156,000 (contract modification). Versatile Avionics Shop Test (VAST) stations for E-2C aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0334.

—Honeywell, Inc., Minneapolis, Minn. $4,500,000. Air munitions for Navy. St. Louis Park, Minn. Naval Air Systems Command, Washington, D.C. N00019-70-C-0530.

—Goodyear Aerospace Corp., Akron, Ohio. $1,223,740. SUBROC guided missile production (Mark 28, Mod 1). $1,743,515 (contract modification). SUBROC missile production. Naval Ordnance Systems Command, Washington, D.C.

—Baird-Atomic, Inc., Bedford, Mass. $2,006,646. Fluid analyses spectrometers. Naval Purchasing Office, Washington, D.C. N00600-70-C-1090.

—Ruscom Construction Co., Charleston, S.C. Construction of nuclear refueling facility at Naval Shipyard, Charleston, S.C. Naval Facilities Engineering Command, Washington, D.C. N62467-68-C-0235.

28—Lockheed Aircraft Corp., Burbank, Calif. $79,389,235. Production of P-3C aircraft. Naval Air Systems Command, Washington, D.C. N00019-70-C-0158.

DEPARTMENT OF THE AIR FORCE

4—General Electric Co., Cincinnati, Ohio. $3,106,880. Stage one nozzles for J-79 aircraft engines. Oklahoma City Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-A-1029.

5—Aerojet General Corp., Sacramento, Calif. $15,994,739. Stage II motors for Minuteman III missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0138.

—Aerojet Liquid Rocket Co., Aerojet General Corp., Sacramento, Calif. $4,500,000. First and second stage engines for Titan III B/C/D. Space and Missile Systems Organization, Los Angeles, Calif. F04695-67-C-0097.

—Explosive Corp. of America, Issaquah, Wash. $1,557,000. Munitions and component parts. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0636.

—Fairchild Camera and Instrument Corp., Syosset, N.Y. $1,407,000. KA-82B camera equipment and related spare parts for RF-4B aircraft. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-3443.

6—Superior Steel Ball Co., New Britain, Conn. $2,630,040. Component parts for munitions. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-1271.

—Goodyear Aerospace Corp., Litchfield Park, Ariz. $1,611,263. All-weather topographical radar mapping systems. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0769.

—General Dynamics Corp., Fort Worth, Tex. $20,768,000. F-111F aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)13403.

—Forsberg and Gregory, Inc., Redlands, Calif. $5,361,757. Construction of family housing units. Davis-Monthan AFB, Ariz. 12th Strategic Aerospace Division, Davis-Monthan AFB, Ariz. F02601-70-C-0260.

7—Aerojet-General Corp., Sacramento, Calif. $3,650,000. Development and production of Minuteman III stage III motors. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04694-67-C-0004 P287.

8—The Boeing Co., Seattle, Wash. $9,816,100. Modernization of ground equipment for the Minuteman III weapon system. Ogden, Utah, and Seattle. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0159.

—Victor Comptometer Corp., Rogers, Ark. $1,423,440. Component parts for munitions. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-0652.

—AAI Corp., Cockeysville, Md. $4,453,413. Design, development, fabrication, test and installation of an AN/ALQ-T5 electronic warfare training simulator. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-1006.

11—The Ogden Air Materiel Area, AFLC, Hill AFB, Utah, issued the following contracts for SUU-30 munitions dispensers:

Lanson Industries, Inc., Cullman, Ariz. $2,374,236. F42600-70-C-0617.

Crescent Precision Products, Inc., Garland, Tex. $5,547,172. F42600-70-C-0608.

American Electric, Inc., La Mirada, Calif. $1,683,374. F04606-69-A-0166.

12—The Armament Development and Test Center, AFSC, Eglin AFB, Fla., awarded the following contracts for the development, fabrication and tests of a 25mm aircraft gun system, GAU-7/A:

Philco-Ford Corp., Newport Beach, Calif. $1,000,000. F08635-70-C-0080.

General Electric Co., Burlington, Vt. $1,000,000. F08635-70-C-0084.

—Northrop Corp., Hawthorne, Calif. $23,618,565. Long lead time items for F-5 aircraft. F33657-69-C-1289. $16,130,722. T-38 aircraft, spare parts and ground equipment. F33657-70-C-0216. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio.

13—North American Rockwell Corp., Columbus, Ohio. $3,721,000. KMU-353A/B guided bomb kits. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0336.

14—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

Lockheed Aircraft Corp., Marietta, Ga. $50,000,000. C-5A aircraft. AF33(657)-15053.

General Electric Co., Cincinnati, Ohio. $8,466,100. J-79 engines, spare parts and aerospace ground equipment. F33657-69-C-1285.

15—General Dynamics Corp., Fort Worth, Tex. $56,552,369. F-111 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33(657)-13403.

—General Electric Co., Philadelphia, Pa. $4,446,340. Research and development of the Mark 12 reentry system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF 04(694)916.

—Aerojet-General Corp., Fullerton, Calif. $1,948,323. Munition dispensers. Armament Development and Test Center, AFSC, Eglin AFB, Fla. F08635-69-C-0045.

—Lockheed Aircraft Corp., Marietta, Ga. $3,387,778. C-5A spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657) 15053.

—Centex Construction Co., Inc., Dallas, Tex. $1,720,000. Construction of 100 family housing units, Bergstrom AFB, Tex. 75th Combat Support Group, Bergstrom AFB, Tex. F41687-70-C-0224.

18—The following contracts were awarded by the Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio:

General Dynamics Corp., Fort Worth, Tex. $18,000,000. F-111 aircraft. AF-33657-13403.

General Motors Corp., Indianapolis, Ind. $2,389,804. TF-41-A1/A2 turbofan aircraft engines. F33657-67-C-0163.

Lockheed Aircraft Corp., Marietta, Ga. $2,514,473 (contract modification). Production and modification of C-141 aircraft. AF33657-14885.

20—Hunt Building Marts, Inc., El Paso, Tex. $2,740,800. 150 family housing units, Luke AFB, Ariz. F02604-70-C-0133.

—North American Rockwell Corp., Anaheim, Calif. $6,000,000. Research and development of the Minuteman III missile post boost propulsion system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-68-C-0040.

—American Electric Co., La Mirada, Calif. $2,597,625. Aircraft ordnance. La Mirada and Long Beach, Calif. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-1316.

22—Lockheed Aircraft Corp., Marietta, Ga. $1,217,651. Aerospace ground equipment for C-5A aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33-657-15053.

26—General Dynamics Corp., Fort Worth, Tex. $1,000,000. F-111 aircraft. Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio. AF33-657-13403.

—Westinghouse Electric Corp., Baltimore, Md. $4,078,400. Electronic countermeasure systems, spares, aerospace ground equipment and applicable data. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-5140.

—Litton Systems, Inc., Woodland Hills, Calif. $1,501,971. Repair and modification of inertial navigational systems for RC 135 and DC-130 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-D-2719.

—General Electric Co. and Del E. Webb Corp. (joint venture), Philadelphia, Pa. $5,393,000. Production and construction of 200 family housing units at George AFB, Calif. F04609-70-C-0132.

27—Texas Instruments, Inc., Dallas, Tex. $1,237,623. Aerospace ground equipment in support of airborne radar equipment for RF-4C aircraft. Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio. F33657-68-C-0379.

—Consolidated Diesel Electric Co., Greenwich, Conn. $6,128,788. Diesel engine driven generator sets (100 and 200 KW) with ancillary equipment and data. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. F04606-70-D-0192.

28—Honeywell, Inc., Hopkins, Minn. $3,907,200. Component parts of air munitions. St. Louis Park, Minn. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-1321.

—Curtiss Wright Corp., Wood Ridge, N.J. $2,203,791. Overhaul and modification of J-65 aircraft engines. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-70-D-2086.

—Ajax Hardware Manufacturing Co., City of Industry, Calif. $3,337,900. Component parts of air munitions. Armament Development and Test Center, Eglin AFB, Fla. F08635-70-C-0217.

—Continental Electronics Manufacturing Co., Dallas, Tex. $3,500,000. Modification of radar systems applicable to Minuteman III. Space and Missile Test Center, AFSC, Vandenberg AFB, Calif. F04697-70-C-0257.

—National Lead Co., Toledo, Ohio. $2,358,047. Component parts for air munitions. Batavia, N.Y. and Toledo. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-1322.

—Lockheed Aircraft Corp., Sunnyvale, Calif. $3,750,000. Design, development, assembly, test and launch support of an unmanned spacecraft. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0035.

—Kollsman Instrument Corp., Elmhurst, N.Y. $4,430,195. CPU-46/A computers, mounting trays, spare parts and data. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-1024.

Defense Industry Bulletin
Defense Supply Agency
Cameron Station, Alexandria, Va. 22314

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Computer-Letters Manage Missile Parts Production

Defense contracts for repair parts are usually low dollar, high density awards that can be plagued by documentation problems and subject to fluctuating supply system demands. Government procurement regulations require buying on a competitive basis, where possible, and that small business concerns be given maximum considerations. New contractors often are manufacturing repair parts for the first time, using drawings produced by the original contractor. Supply system demands often change after initial request and require a management system equally flexible and responsive.

To eliminate problems connected with buying missile repair parts, the Procurement and Production Directorate of the Army Missile Command, Redstone Arsenal, Ala., devised a letter-computer management system. A series of standard letters, initiated at appropriate times by the computer and printed, with proper envelope, on a line printer, have been developed to speed up solutions to four problem areas in repair parts contractor performance:

- To prevent inadequate documentation early in production, the first letter is sent to the manufacturer 90 days before contract delivery date and alerts him to the fact that he has a contract or purchase order, verifies all the controlling numbers involved, and asks him to check for any discrepancies.
- To prevent slippage, 60 days before scheduled delivery, a second letter asks the contractor to notify the contract administrator in the cognizant Defense Contract Administration Services Region, if there are problems likely to cause a slippage in delivery.
- To accelerate the delivery schedule in the event stockage condition requires it, another computer-printed letter asks the manufacturer if it is possible to ship early at no extra cost to the Government. Stockage levels, functional criticality, and deployment codes programmed into the computer initiate this letter which is then screened by Missile Command managers. This automatic action answers unanticipated demands in the supply system without exceptional management attention.
- To provide incentive to deliver or begin early problem solution, a letter is sent to the contractor 10 days after his contract becomes delinquent, and a follow-up letter is sent 40 days after the scheduled date. These letters tell the manufacturer that he is delinquent and ask for the reason for slippage, or that he verify the shipping information if records are in error.

With all the letters, a self-addressed envelope is enclosed for convenience of the recipient, and the letters request that answers be made on the reverse side of the letter to increase responsiveness.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1970 393-619/12

DEFENSE INDUSTRY BULLETIN

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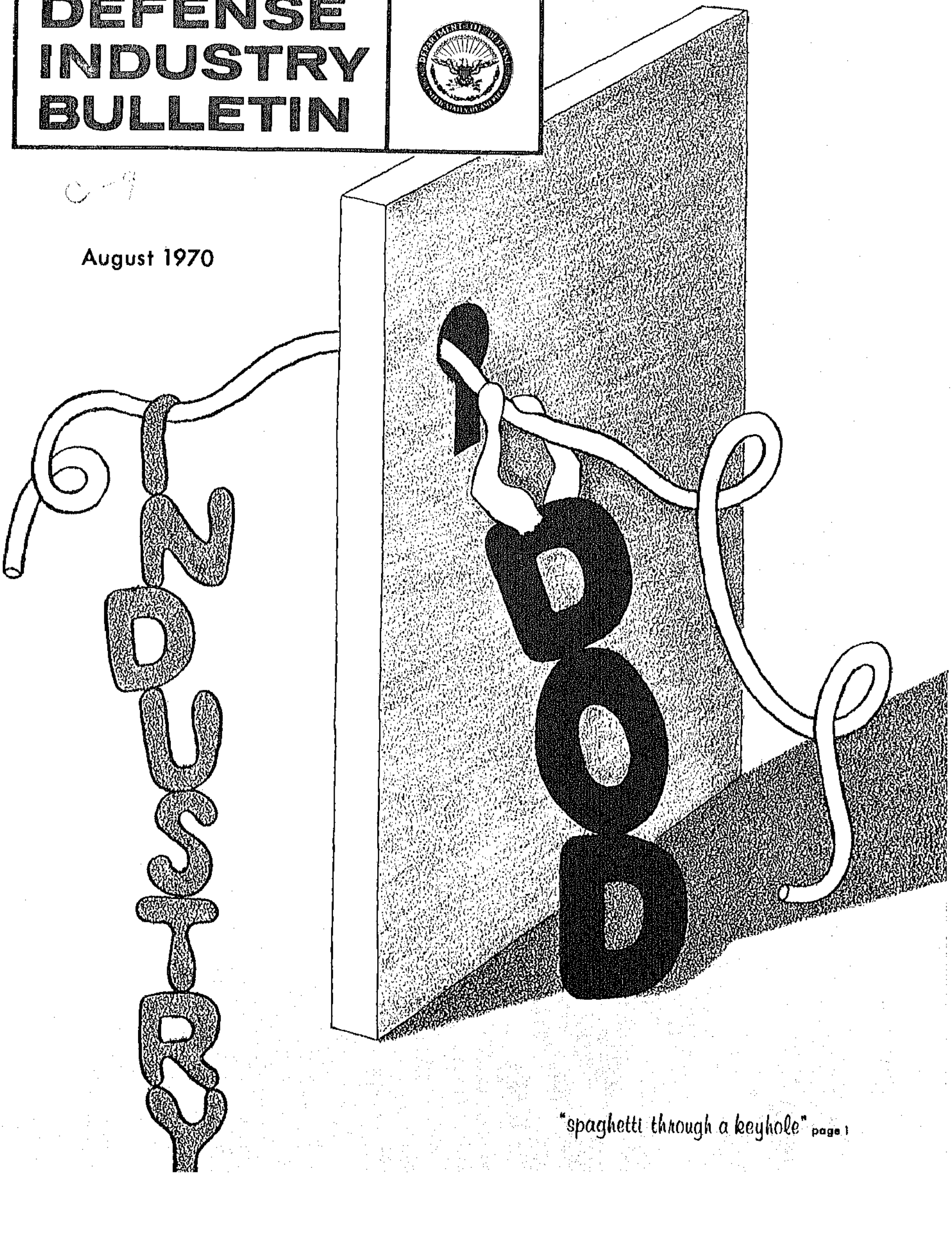
August 1970



"spaghetti through a keyhole" page 1

DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 8 August 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds approved by the Director, Bureau of the Budget, Nov. 2, 1965.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

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DEPARTMENTS

Defense Technology: Benefits to Industrial Progress

Dr. Donald M. MacArthur

The mission of the Defense Department is to provide for the security of our country. To do this, the department must acquire new weapons and military systems, and develop and maintain a technological base on which these systems depend.

In performing this mission, there has been a "spin-off" of technical innovations, often overlooked, which have contributed immeasurably to the nation's industrial and economic growth. Jet engines, jet aircraft, radar, titanium, communication and navigation satellites are a few examples in which DOD has played a vital role.

We might ask whether these technological developments would not have happened anyway. The answer is yes. They probably would have been developed anyway, but much later. DOD had the first recognized need for them—a need which was strong enough to justify the expenditure required to develop them. Thus, they came into being much earlier than they would have otherwise, and so increased the pace of U. S. industrial progress and economic growth.

Special efforts are made to foster transfer of defense-related technological information to the private sector where there is a commonality of interest between DOD and other organizations, both governmental and private. Because these DOD activities do benefit the general economy, it would be useful to describe the policies of DOD in this area, the factors that influence DOD in making the innovation in the first place, and the processes by which the innovations and their associated technologies are transferred to other sectors of the economy. This is what I want to discuss in this article.

First, I want to be very clear on one point. The overriding contribution of the Defense Department to industrial welfare is the assurance of national security. Sometimes this is lost in our enthusiasm as we discuss spin-off contributions to the economy, but a strong and dependable national security underlies all of our economic growth.

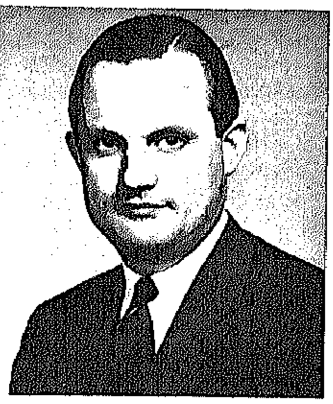
With regard to DOD relationships with the private sector, we do everything we can to foster the welfare of every segment of our society. To implement this, Secretary of Defense Melvin R. Laird established a high level council—the Domestic Action Council. This council has responsibility to find and implement ways in which the department can make even greater contributions to our pressing domestic problems. This was not a purely altruistic act on Secretary Laird's part. There were two reasons for his action.

First, it is evident that our defense capability and our national security rest fully as much on the strength and solidarity of our society at home as they do on our military forces and the systems they operate, either for deterrence or defense. Second, it is equally clear that demands on our national resources are growing rapidly, and we must secure the maximum benefit to all sectors of the United States from every investment made and from every resource that can be applied.

There is one caveat, however. Each program, which may alleviate some domestic problem, must also be of direct benefit to DOD. We would not request, nor would Congress appropriate, DOD funds for purposes not directly associated with the DOD mission of national defense. In fact, DOD has long standing policies that require all research and development programs to be relevant to military service mission requirements. Congress recently reemphasized this restraint in the FY 1970 Defense Appropriation Act. Title II, Section 203, of this act states that none of the funds authorized "may be used to carry out any research project or study unless such project or study has a direct and apparent relationship to a specific military function or operation." But there are many occasions when problems of DOD are also confronted by other organizations, both public and private. Clearly, we can increase our return on the investment of public funds, if we are aware of these needs and transfer our innovations to those who can use them.

Two examples of current projects illustrate this. One is concerned with housing, the other with hospitals.

DOD provides housing for many



Dr. Donald M. MacArthur is Deputy Director (Research and Technology), Office of Director of Defense Research and Engineering. The programs he directs cover rocket and missile propulsion, materials technology, medical, life, social behavioral and environmental sciences, and chemical technology. Dr. MacArthur holds a B.S. degree from St. Andrew University, Scotland, and a Ph. D. in X-ray crystallography from Edinburgh University, Scotland.

military personnel and their dependents. At the present time, DOD owns approximately 370,000 family dwellings, representing an acquisition cost of over $5 billion and a much larger replacement cost. DOD must maintain these units. It is necessary to build from 5 to 10 thousand new units annually to replace old dwellings. The current cost of new units is about $19,500 each. It is obvious that reductions in acquisition and maintenance costs of family units would save substantial sums for DOD.

About two years ago, we initiated a number of studies on housing construction methods that would reduce the overall costs by 15 to 20 percent. We are now starting construction of 200 family units at George AFB, Calif., to test the concepts and ideas generated by these studies. In particular, we will test the feasibility and economics of a mobile factory concept for housing construction. Needless to say, we have kept the Department of Housing and Urban Development fully informed of this work.

There are several reasons why DOD is in a good position to do this work. First, DOD's inventory of housing is large enough so that reduced costs through research and development would produce a big payoff. Second, DOD owns Federal property where demonstration units, like those at George AFB, can be built with somewhat greater flexibility because of the absence of traditional building codes and zoning laws. Finally, DOD has the technological capability to do the research and development work, and it has the administrative structure to accumulate comparative construction and operating costs, records of consumer acceptance, and other data over an extended period of time.

Another project, initiated by DOD, concerns the reduction of the rate of increase of hospital costs. DOD operates a very large health care program and owns 230 hospitals with annual operating costs of $1.8 billion. These costs, like those in the private sector, are increasing at an alarming rate. Two competing studies have been completed applying an overall systems analysis of our total military health care system. The concepts emerging from this systems approach will be incorporated in a "new generation" prototype hospital to be built in 1972. The Department of Health, Education and Welfare and the Veterans Administration have been participants in the design of the program and selection of contractors.

There are numerous other examples of efforts by DOD with other Federal agencies, such as the Departments of Justice and Transportation, and the Atomic Energy Commission. There are also numerous mechanisms to transfer DOD technology to industry. I will discuss these later.

Source of New Technology

Why is DOD such a major source of new technology?

I believe that there are two reasons for this. The first is urgency. Where there is solid information which indicates that a rival power is overtaking our military superiority in a particular field, then a sharp sense of urgency is felt. It leads to an immediate analysis of possible technological and operational responses, a driving urge to push available technologies to the limit, and the establishment of a strongly motivated organization to adapt and mesh the technological effort to the problem at hand.

The second reason for DOD's leading role is the scale usually demanded by the situation. This is also of special importance to the civilian economy, for it is one of the factors most responsible for transfer of DOD technology to industrial practice. For example, DOD needs for aluminum led the department to do much of the work which made possible the production and fabrication of this metal, and provided the basic engineering design data necessary for its use.

DOD also supplied the original market large enough for industry to achieve production economies so that aluminum now is found in countless consumer products. The same process has occurred at a different stage in titanium, and is presently happening with composite materials. American industry is now making a substantial investment in these new materials. And because industry is now devoting substantial resources to these materials, DOD can reduce its commitments and extend its efforts to newer technologies. In a very real sense, it is a "seed money" situation of profit to both parties.

Technology Transfers

The examples I used might give the impression that the process of technology transfer is easy. In actual fact, it is far from easy. Let me briefly explain why.

There are three categories of technology, and each differs in respect to its ease of transfer, the types of industry to which it can best be transferred, and the cost effective methods of transfer. The three categories are:

- Total systems (aircraft, radars, communication satellites).
- Components and materials (transistors, aluminum, composite materials).
- Techniques, processes and concepts (welding, explosive forming of metal parts, plasma plating, and systems analysis).

Transfers from the first two categories (total systems, and components and materials) are relatively straightforward and uncomplicated. Transfer from the third category is usually difficult, and depends very much on special skills and thorough understanding by the recipient.

Without going into detail, we have concluded that the limiting factor in transfer from the first two categories is largely economic. Industrial organizations which can adapt and use whole systems have highly capable research and development organizations. Companies which develop components and materials for DOD also serve the civilian market and they, too, are knowledgeable and competent. Both types are aware of new developments as they are occurring, and both frequently participate in the development.

I said that the limiting factor was economic. As an example, the transistor was an industrial invention. Its performance advantages over the vacuum tube were both highly attractive and immediately apparent. But it was also far more expensive—as much as 10 to 15 times. However, the military market, which placed a high value on performance, eventually demanded enough transistors so that mass production techniques were devised. Mass production lowered unit cost to the point that the transistor could be adopted by the home entertainment electronic industry.

The transfer of techniques, pro-

cesses and concepts is very much more difficult. In addition to the economic aspects, the transfer is controlled to a great extent by the technical skill, conceptual ability, and creative drive of the potential recipient. Our experience has been that for three-fourths of the cases, in which a new manufacturing process was successfully transferred within the defense community, direct communication between people was necessary. Only in one-fourth of the cases could the transfer be made through written reports. I suspect that a similar ratio would be the case in the industrial community.

Why the Difficulty

There are three misconceptions which are widely held and, unfortunately, act as barriers to transfer of technology.

First, it is not true that *most* DOD technology is marketable by industry. Many times our requirements for high performance and reliability lead to high cost technology not compatible with the facts of the marketplace. However, if DOD requires the item in large numbers, then frequently industry will discover production economies which will make it, or some of its components, attractive for commercial exploitation. This was the case in the example of the transistor.

The second misconception, related to the first, is that DOD technology can be used directly for commercial purposes. This simply is not so. There is a cost of bringing new ideas to market—perhaps 80 to 90 percent of the whole innovative process. Production start-up, manufacturing, testing, licensing, and a myriad of other efforts are necessary.

Finally, there is the third myth that technology transfer can be fostered and increased by government efforts alone. That is like trying to push a piece of wet spaghetti through a keyhole. DOD can do the "push" part, but to get the job done there has to be a "pull" on the other end. That is what industry has to do if it wants to exploit defense technology.

How does DOD do its "push" part of technology transfer?

We publicize areas of procurement interest and contract awards. We foster the sharing of services and facilities (wind tunnels, accelerators, test equipment) which transfers technology and accomplishes face-to-face communication. We have a liberal and flexible patent policy. Finally, DOD has a strong technical information program designed to transfer technical reports within the Government and among defense contractors, as well as make maximum information available to the general public. During FY 1969, for example, approximately 1.9 million DOD technical reports were requested through the Defense Documentation Center and the Department of Commerce Clearinghouse for Technical and Scientific Information.

Changing Environment

These have been the patterns of the past. I fear they may not be adequate to the challenge of the future. There is nothing new in saying that the rate of change in the world is increasing very rapidly. It is true and it must be understood. The social and economic expectations of our people, and of people everywhere, grow and create insistent problems which must be solved. Populations grow and pose problems of hunger, disease and conflict. The pattern of industry changes. For example, we no longer gain our major economic growth from the extractive industries; and problems of industrial obsolescence and displacement arise.

Technology can help solve many of these problems—not all of them by any means, but a significant number. Our technological options and opportunities are increasing at an explosive rate, seemingly increasing the power of technology to contribute to human welfare.

However, there are strong counterforces as well. There are many people today who believe that technology creates as many problems as it solves, *e.g.*, pollution and the quality of our environment. They urge a halt to the proliferation of technology. Others believe that the time has come to divert funds from further technological progress to action programs aimed at alleviating many of our social problems. Others believe that technology is primarily responsible for escalation of the arms race. These criticisms, doubts and reservations are communicated to the Congress, and are being reflected in budget appropriations.

The result is that as our problems and our technological opportunities grow exponentially, support for technology relative to the opportunities it offers is decreasing. There was a time when we could fund all or most of the creditable and relevant technical ideas we had. We can no longer do this, and the resulting need to be selective can only increase. We are in a period when we must move from a strategy of parallel search to a strategy of selective choice, and be more conscious of the social implications of the product.

Whether we are technical managers in industry or in Government, we will have to manage technology better, and find ways to select the best from a large array of the good. How shall we choose, and by what criteria?

What is the marginal utility of that which we decide to discard, and of that to which we give support?

How can we avoid catastrophic error on the one hand and the safe, uninspired pedestrian approach on the other?

I am inclined to avoid any sweeping generalities—whether criticism or applause—about the interactions between defense research and development and industrial research and development. But on one generality I think we can agree. Modern business and modern government, like modern defense, depend upon a science-based technology to which all of us contribute and from which all benefit.

If we have learned anything from past attempts to exchange knowledge and to multiply the uses of new knowledge, it is that scientific and engineering professional communities of the nation can be indispensable "brokers" in the exchange process, in addition to providing high caliber technological leadership as they have in the past. Perhaps we should continue our effort working together in this area at all levels of government and all sizes of business. In addition, I think one of the most needed and rewarding tasks of the future will be to replicate, on the state and local government levels and through smaller businesses, the successes achieved in the past at the Federal level and through large businesses.

This is an area where large needs and great opportunities exist today. DOD will push—I hope you will pull.

Naval Civil Engineering Laboratory

Solving Problems On and Under the Oceans

Commander A. F. Dill, CEC, USNR

To conduct research and to develop, test, and evaluate techniques, equipment, material, and structures best suited for the construction, maintenance, and operation of facilities for advanced bases, amphibious forces, seafloor operations and the shore establishment. For 22 years the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, Calif., has followed that precept in probing an assortment of problems confronted by fleet and shore establishments.

Under the Naval Materiel Command, the laboratory employs 360 people, including about 15 military, and operates under an $8 million budget.

A staff of 165 scientists and engineers includes civil, mechanical, electrical, hydraulic, electronics, chemical and structural engineers as well as chemists, marine biologists, metallurgists, physicists, mathematicians, geologists, and operations research analysts. Organization of NCEL is shown on page 7.

Private industry plays a role in NCEL's prime objectives. About 20 percent, or $1.6 million, of the laboratory's efforts are contracted with industry each year. Commercial firms also use some of NCEL's unique facilities for test programs.

Conversely, NCEL specialists are often summoned by outside sources, military and civilian, to investigate problems, and frequently offer on-the-spot solutions. What cannot be solved at the scene is returned to NCEL for more extensive research and development.

The laboratory's main efforts have been in the fields of ocean engineering, protective structures, high quality electrical power, waterfront structures and harbor facilities, deterioration control, soils and pavements, systems analysis, secure communication and Vietnam assistance.

NCEL's primary interest is the sea. With the accelerated interest in the oceans, the ocean engineering program has been expanded until approximately 40 percent of the laboratory's funds currently are allocated to ocean engineering projects. It is expected that the laboratory's industrial contracts may double in the near future, in keeping with increased

rowth of ocean engineering pro-
rams.

Briefly, NCEL's ocean engineering rogram supports the Navy's seafloor perations. The program includes re-earch, development, test and evalua-on in materials, equipment, con-truction techniques, and installations n the ocean floor. Other investiga-ons involve the development of new nd more effective equipment and pro-edures for salvage at sea.

The program involves specialists rom many organization groups ithin the laboratory. There are bout 40 engineers and scientists with aried ocean engineering experience. n addition, professional staff mem-ers from other departmental disci-lines are called upon to assist with pecific problems.

Among these is a prefabricated rototype storage or repair structure or use underwater at depths of 50 eet. The structure uses quick-connec-ors and specially fabricated panels eveloped at the laboratory. Called iivercon I, the project is part of an xtensive program to develop ade-uate knowledge, techniques, systems, nd equipment to support diver con-truction operations on the continen-al shelf. Divercon I places major em-hasis on divers handling components n the seafloor without dependence pon the surface. It is a 10-foot diam-ter structure composed of three sec-ons using large structure construc-on techniques. A variable-buoyancy oat "sky hook" and a hydraulic inch are used for lifting operations, ith divers controlling buoyancy of e float and operating the winch.

NCEL also is developing an under-ater "pickup truck" called CAV Construction Assistance Vehicle). he experimental diver-operated work ehicle, presently designed for a max-num depth of 120 feet, will trans-ort divers, tools, power supplies, and quipment to ocean-bottom construc-on and salvage sites. The vehicle ilizes off-the-shelf hardware such as ectro-hydraulic power packages, l-immersed lead batteries, and hy-raulic-motor-driven propulsion. An-her underwater "vehicle" is NEMO Naval Experimental Manned Ob-rvatory), a 66-inch-diameter acrylic astic sphere. Developed jointly by CEL and the Naval Missile Center, Point Mugu, Calif., NEMO will allow two observers to descend to an opera-tional depth of 600 feet in a shirt-sleeve atmosphere, and enjoy pano-ramic visibility.

The evaluation of the sphere, made of 12 identical pentagons of acrylic, under simulated operational service marked the successul completion of the first phase in the development of spherical acrylic hulls for manned op-erations in hydrospace. NCEL used its six-foot-inner-diameter pressure vessel to subject the prototype NEMO hull to various test. The hull was tested for about 2,500 hours inside the vessel under varying pressures and water temperatures. Sea water was pumped into the vessel, adding to the oceanlike environment of test condi-tions. During that time, the acrylic hull withstood 335 hours of hydros-tatic loading applied during 61 simu-lated dives at depths from 225 feet to 2,400 feet. Although the stainless steel hatch and bottom plate yielded somewhat during the simulated maxi-mum depth dives, no visible damage was observed in the hull.

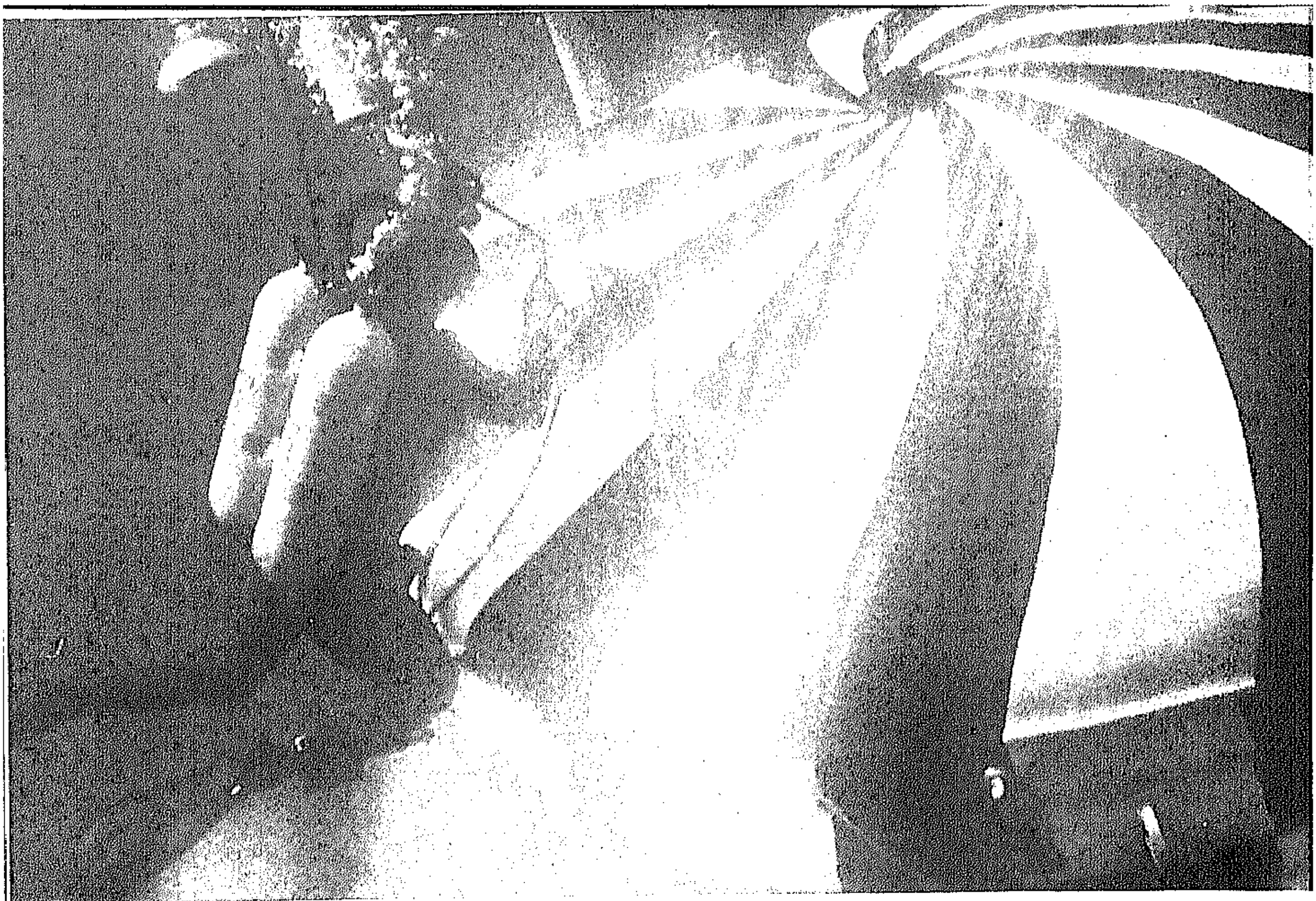
An extensive program to develop design guidelines for seafloor footing foundations has been furthered by de-velopment of the LOBSTER (Long-Term Ocean Bottom Settlement Test for Engineering Reasearch). The LOBSTER is a model footing capable of monitoring its own performance, designed for depths of 6,000 feet and deployments up to one year. The foot-ing imposes a 100-pound per square foot load on soft sediments and, dur-ing emplacement, accumulates data on total and differential settlements.

A large, high pressure vessel (one of two on the West Coast) is part of NCEL's deep submergence simulation facility which provides the capability of simulating the hydrostatic loading conditions of any ocean depth with sea water. In addition to supporting work units from the Naval Facilities Engineering Command (NAVFAC), the facility is available to other gov-ernment agencies and to industry. The laboratory can provide test facili-ties for private industry when they don't interfere with government-spon-sored laboratory programs.

The facility consists of 22 pressure vessels, ranging from a five-inch (ID) 50,000 psi unit to the 72-inch vessel, with a working length of 120 inches and 5,500 psi. The laboratory has pro-vided three basic types of testing cap-abilities: proof tests of equipment under external hydrostatic pressures as high as 20,000 psi; functional test-ing of electromechanical and elec-tronic systems under pressure; and evaluation of electrical cables and connector systems under high pres-sures and in sea water.

Companies desiring use of the pres-sure vessels should contact Oceanog-rapher Kenneth Gray of the Ocean Engineering Department. Charges for the 72-inch are approximately $600 per day, including the services of an oceanographer, two technicians and two riggers to handle heavy equip-ment. Charges for the smaller units are substantially less. The main cri-teria for use of the facilities is that the facilities are unique, hence not commercially available, and that the private tests do not interfere with government-sponsored laboratory pro-grams.

Commander A. F. Dill, CEC USNR, is Commanding Officer of the Naval Civil Engineering Laboratory. Preceding his as-signment to NCEL, he was as-signed to the Defense Atomic Support Agency Test Command and detached to the Air Force Weapons Laboratory as Chief, Civil Engineering Branch. Com-mander Dill holds a bachelor of science degree from the U.S. Naval Academy, bachelor's and master's degrees in civil engi-neering from Rensselaer Poly-technic Institute, and a PhD. from the University of Illinois.



In 50 feet of water, DIVERCON is given initial tests. Part of an underwater construction program, it will eventually be tested to 600 feet.

At least a dozen commercial firms have used NCEL's pressure complex on an available time and space basis.

In the field of material corrosion studies, NCEL has been conducting evaluation programs in the ocean off Ventura County since 1961.

A series of eight Submersible Test Units (STUs) have been emplaced in the deep ocean. The latest one has been placed in 6,000 feet of water and will be brought to surface in December 1970.

More than 20,000 specimens of steel, woods, metal alloys, paints, ropes, plastics, and other materials have been tested. Approximately 12,000 of the specimens have been furnished by private industry. It is estimated that since the laboratory initiated its corrosion program, commercial companies have spent about $250,000 in services, costs and materials, taking advantage of this NCEL testing facility.

Information derived from STU served as guidelines to determine the best materials for the new Deep Submergence Rescue Vehicle (DSRV–I) in terms of preventing potential corrosion problems.

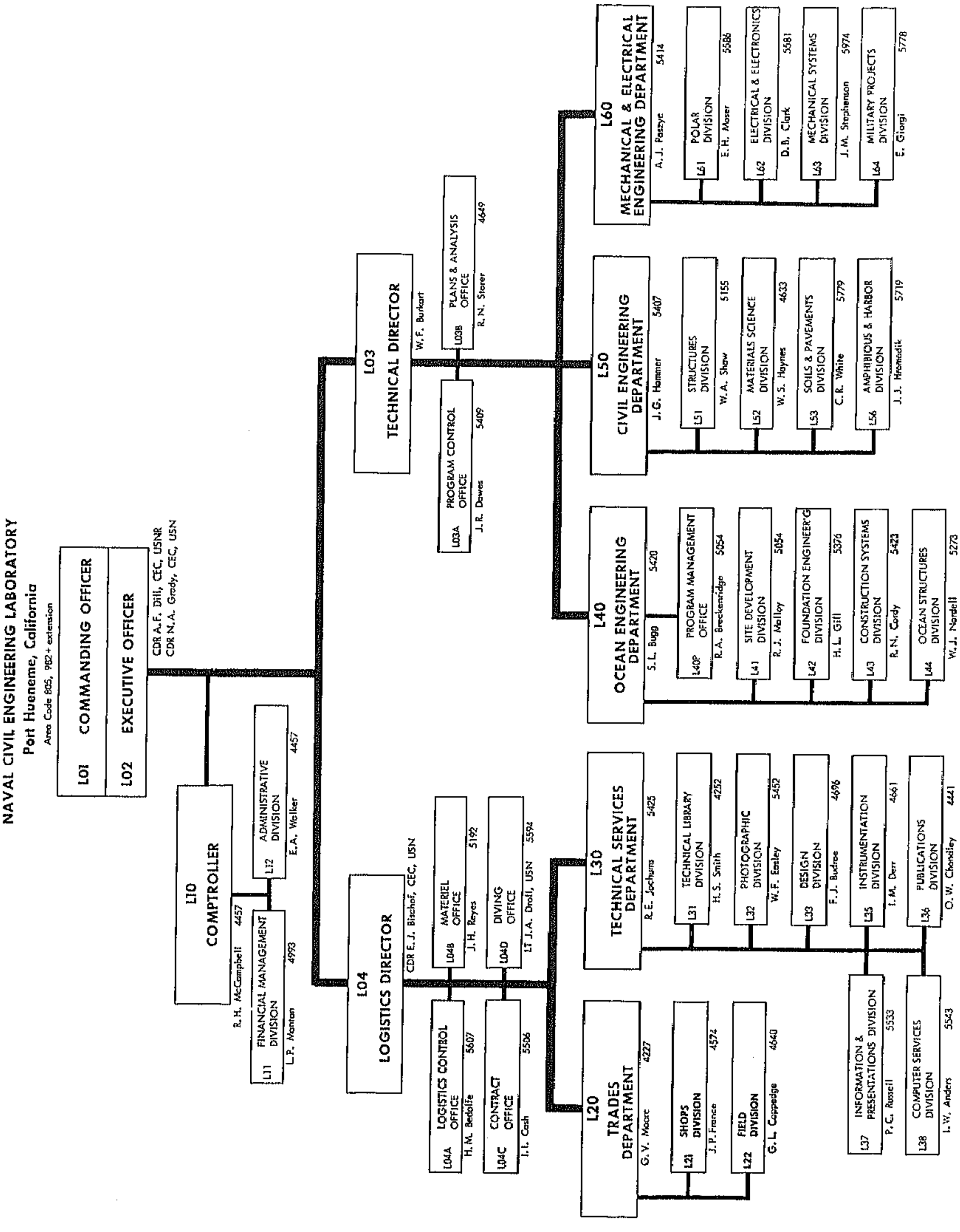
Industries interested in specimen testing on the STU can contact Metallurgist Fred Reinhart of the Civil Engineering Department for information on NCEL's material testing programs.

Through its Civil Engineering Department, NCEL investigates improved systems and techniques for conveying cargo during amphibious operations. One concept is the portable port which converts an unprotected beach into a berthing facility capable of handling most naval and commercial cargo ships. The system includes a T-shaped pier, breakwater, shore storage, fueling station and dock for unloading ammunition. A second concept consists of a straight pier attached to an adaptor ship. The port will be transported or towed to a beach site. After it fulfills its purpose, the port can be retrieved and stowed for future use.

Of special concern to NCEL in recent years has been its Vietnam Laboratory Assistance Program (VLAP). Engineers and scientists have gone to Vietnam to correct slick airfield surfaces, blowing dust, erosion problems, pollution of local water tables through poor sanitation, structural problems, corrosion, bridge sabotage and a host of other difficulties.

Many laboratory programs bear directly on the Seabee and the Mobile Construction Battalions (MCBs). For example, the laboratory has studied MCB hand tools to provide the least expensive, most durable and most useful tools in history. Some of the research, test and evaluation of hand tools underway at NCEL is the first of its type for hand tools.

An active program in the development of high quality electric power is also underway at NCEL. Users of electrical power have found that their



NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California
Area Code 805, 982+ extension
L01 COMMANDING OFFICER
L02 EXECUTIVE OFFICER
CDR A.F. Dill, CEC, USNR
CDR N.A. Grady, CEC, USN
L10 COMPTROLLER
R.H. McCampbell 4457
L11 FINANCIAL MANAGEMENT DIVISION
L.P. Manton 4993
L12 ADMINISTRATIVE DIVISION
E.A. Walker 4457
L03 TECHNICAL DIRECTOR
W.F. Burkart
L03A PROGRAM CONTROL OFFICE
J.R. Dawes 5409
L03B PLANS & ANALYSIS OFFICE
R.N. Storer 4649
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L60 MECHANICAL & ELECTRICAL ENGINEERING DEPARTMENT
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L61 POLAR DIVISION
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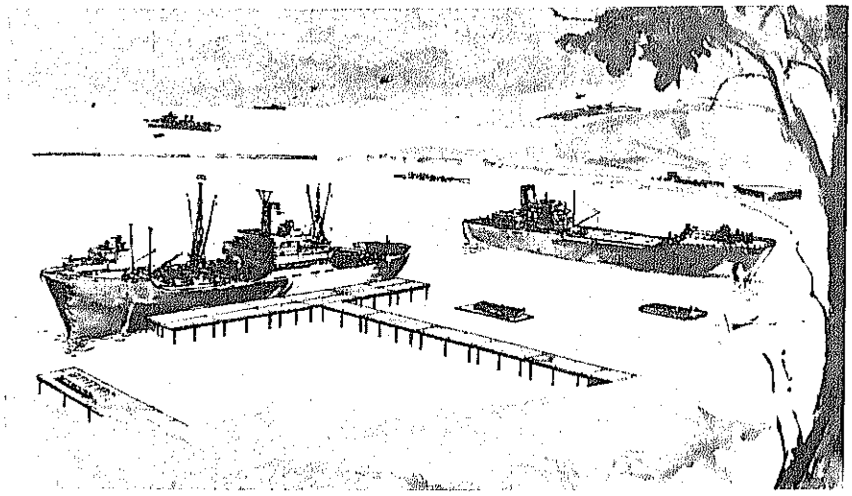
L63 MECHANICAL SYSTEMS DIVISION
J.M. Stephenson 5974
L64 MILITARY PROJECTS DIVISION
E. Giorgi 5778



Left: One of the new concepts of converting unprotected beaches to berthing facilities under study by NCEL.
Right: CAV, an underwater pickup truck, is designed for depths of up to 120 feet. It uses electro-hydraulic power packages, oil-immersed lead acid batteries and hydraulic motor-driven propulsion units.

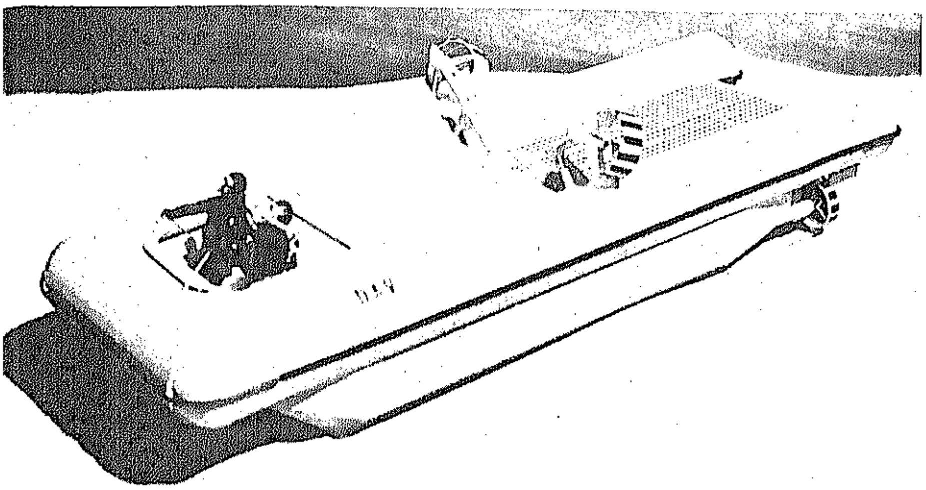
sensitive electronic equipment cannot tolerate milli-second power losses and minor voltage peaks and transients which rarely affect offices and homes.

Engineers at NCEL are investigating filters and auxiliary equipment which improve existing electrical power delivered to electronics equipment and which may help to eliminate many errors made by computers and cryptographic devices using conventional power sources. In addition, laboratory engineers have explored ways of modifying equipment instead of power sources, thus "desensitizing" the electronics equipment to many transients existing on today's conventional power sources.

As a part of the Joint Defense Communications Agency and Military Department Worldwide Electric Power Improvement Plan (1971–75), NCEL is monitoring power sources with power transient data acquisition monitors at Defense Department bases. Engineers from NCEL are also determining the transient sensitivities of operational electronic systems using a power transient synthesizer developed at the laboratory.

Other technical highlights in NCEL's efforts in FY 1970 include:

- Requirements for a prototype underwater laser surveying system were formulated jointly by NAVFAC and NCEL. The fabricated system is designed for use by scuba divers at depths of 60 feet. The laser instrument is a battery-powered, pulsed Argon gas unit mounted on a specially designed tripod with a leveling head. The system was first used in the Virgin Islands, surveying bottom sites for Project Tektite I.
- The laboratory participated in seven different projects during Operation Prairie Flat: a 500-ton TNT blast and shock experiment conducted at the Defence Research Establishment Suffield, Canada. It was designed to provide experimental data required for the solution of various nuclear effects problems. NCEL was involved in the testing of capsule-shaped structures and model silos.
- Two blast-closure valves developed at NCEL were proof tested during Operation Prairie Flat. A Breckenridge valve performed satisfactorily at overpressures of approximately 7 psi and 150 psi and was judged to be operational for future buried installations. The 10,000 cubic feet per minute blast valve, although not tested to full design capacity, also functioned satisfactorily. Further testing at higher overpressure levels was recommended.
- A 35-by-40 foot concrete funicular shell was tested under concentrated and uniformly distributed static loads. The laboratory's Structures Division found that such shells are remarkably strong and are expected to be useful in the Naval Shore Establishment and in civil construction wherever roof and floor elements are used. The shell was 2 inches thick with a maximum rise of 2.5 feet. It supported a uniformly distributed load of 135 pounds per square foot before local failure. Subsequently an undamaged portion of the shell was subjected to a concentrated load of 10,000 pounds before a punching failure occurred.
- Load curves were developed for the operation of C–121, C–124, C–140, C–141, and C–5 aircraft on the McMurdo, Antarctica, annual sea-ice sheet. The curves were based on elastic theory and the mechanical properties of ice sheets as determined by NCEL field and laboratory tests. The findings, comparing favorably with empirical data, are used by the Naval Support Forces, Antarctica, to develop sea-ice runways.
- Significant progress has been attained on two separate anchor programs. An exceptional type of propellant embedment anchor under development for the Supervisor of Salvage was field tested. Major goals are holding capacities up to 100,000 pounds and the ability to function in seafloor compositions of sand, mud, coral, and rock. A hard ocean bottom (rock or coral) presents the most severe marine salvage problem for conventional anchors. The new anchor demonstrated good potential, particularly in hard bottom sites. Successful embedment and a holding capacity of 168,000 pounds was achieved in rock.
- A unique vibratory anchor is being developed for NAVFAC to improve deep water mooring capabilities. Major goals include a 50,000 pound holding capacity and deployment at depths of 6,000 feet. Shallow water tests indicated holding capacities greater than 50,000 pounds.



In addition to cooperating with other Federal agencies in the development of its anchor projects, NCEL has gone to a number of private firms for valuable contributions. Major companies have been awarded contracts to design and fabricate anchor concepts. All told, approximately six industrial groups have been involved.

A unique cathodic protection system was developed to protect ground tackle (mooring chain) from corrosion. Protection was achieved in both muddy and sandy bottoms. An annual savings of about $1 million has been estimated within the naval shore establishment.

Other research underway at NCEL covers a wide spectrum of technical projects. The laboratory is working on the technology of wood deterioration control, concrete and cement materials, metal corrosion, protective coatings, plastics and related chemistry applications. Experts in soil mechanics perform project work in soil stabilization, earth dynamics, and the construction of runways, roads and foundations.

Once NCEL has solved a problem, it communicates findings to the working level through technical reports on finished projects, technical notes when milestone markers are attained, and technical data sheets, which condense pertinent information for wider dissemination. The laboratory also considers that personal contact is vitally important to the customers. Experts constantly tour field activities where they assist local personnel in applying lessons learned at NCEL.

From the Antarctica to the Arctic, and on and under the oceans between, NCEL is pursuing the Navy's civil engineering problems. A pursuit whose goal was stated by arctic explorer Rear Admiral Robert E. Perry, and has since been adopted as NCEL's motto: "I will find a way or make one."

NCEL Technical Reports

The following technical reports on work performed by NCEL are extracted from a bibliography compiled by the Defense Documentation Center. Space limitation in the *Bulletin* allows publishing only a partial listing. The reports listed and a complete bibliography may be obtained by registered organizations without charge from:

Defense Documentation Center
Cameron Station
Alexandria, Va. 22314

All organizations may purchase microfiche or full sized copies of these reports (65¢ and $3, respectively, prepaid) from:

Clearinghouse for Federal Scientific and Technical Information
Department of Commerce
Springfield, Va. 22151

All reports listed are unclassified.

Shock and Vibration Testing—Current Theory and Uncertainties. H. A. Gaberson, NCEL, March 1970, 53 p., AD-867 453L.

An Evaluation of Deep Ocean Research Vehicles. John B. Ciani, NCEL, Feb. 1970, 86 p., AD-865 362L.

Splash-Zone, Underwater-Curing, Epoxy Coatings. Richard W. Drisko, NCEL, Oct. 1969, 42 p., AD-863 030L.

Rigid Body Response of an Elastically Restrained Cylindrical Deep Ocean Structure to Detonation-Induced Underwater Shock. Harry S. Zwibel and John G. Hammer, NCEL, Nov. 1969, 31 p., AD-861 848L.

Corrosion of DSRV Materials in Sea Water—Six Months Exposure. Fred M. Reinhart, NCEL, July 1969, 31 p., AD-857 325.

Guide to NCEL Technical Documents. Jan. 1968, 265 p., AD-844 332L.

Deep Ocean Power Systems. E. Giorgi, NCEL, Sept. 1968, 128 p., AD-843 783.

Glass Reinforced Polyester Coatings for Steel in Marine Atmosphere. Carl V. Brouillette, NCEL, Sept. 1968, 26 p., AD-843 139L.

Constant Back Pressure Receiver for Ocean Hydraulics. Dharam N. Pal, NCEL, June 1968, 34 p., AD-837 792.

Ocean Bottom Breakout Forces, Including Field Test Data and Development of an Analytical Method. Bruce J. Muga, NCEL, June 1968, 152 p., AD-837 647.

Corrosion Rates of Uranium Alloyed Steel in Marine Hydrospace. Carl V. Brouillette, NCEL, Feb. 1968, 23 p., AD 829 844L.

Analysis of Ocean-Floor Soil Samples by X-Ray Diffractometry and Infrared Spectroscopy. G. R. Glenn, NCEL, Jan. 1967, 51 p., AD-822 263L.

Bonding to Steel of Underwater-Curing Epoxies. Richard W. Drisko, NCEL, Sept. 1967, 21 p., AD 821 145L.

Test of Zinc Inorganic Coatings on Work Areas of a Floating Drydock—Results of 25-Month Inspection C. V. Brouillette, NCEL, May 1967, 23 p., AD-816 102L.

Nine-Year Program on Marine Atmospheric Exposures of Protective Coatings for Steel, C. V. Brouillette, NCEL, Jan. 1967, 96 p., AD-808 282L.

Investigation of an Insulating Material for Deep Ocean Habitat Environments. S. C. Garg, NCEL, Sept. 1969, 27 p., AD-694 466.

NCEL Underwater Air Supply System. C. R. Hoffman and D. Pal, NCEL, May 1969, 43 p., AD-687 716.

Role of Value Engineering in the 1970s

Richard E. Biedenbender
Rudy H. Kempter

There are several ways of achieving specified levels of defense capability. One way is to invest more resources. However, most knowledgeable observers expect defense expenditures in the 1970s to decrease, at least in relative terms to the Gross National Product and expenditures for other national, social, and environmental needs.

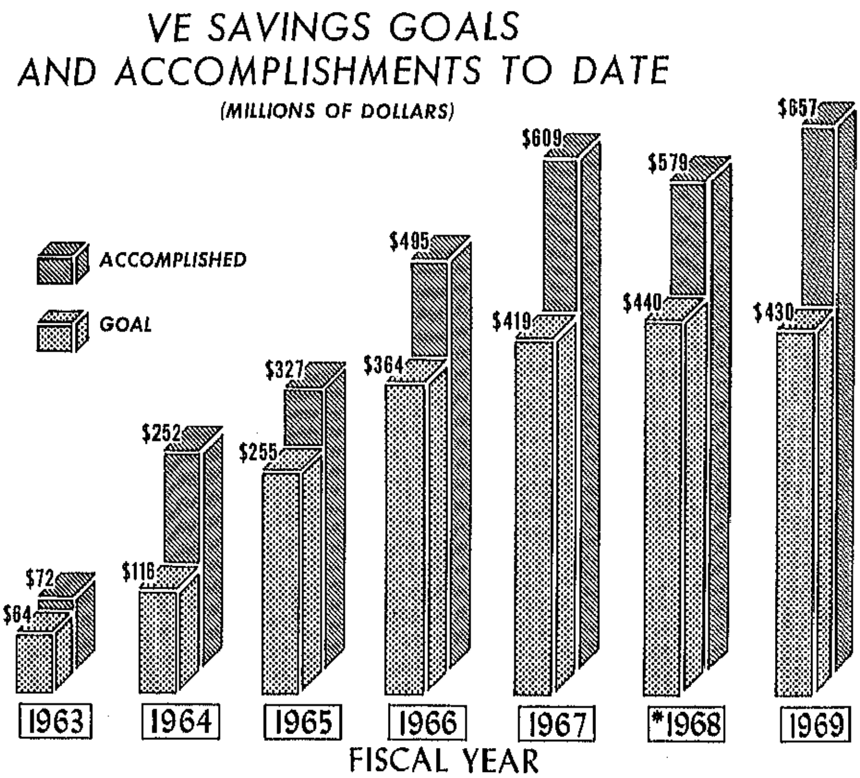
We must, therefore, look toward a second manner to provide the necessary military capability: more effective and efficient use of allocated defense resources. One approach to this objective is Value Engineering (VE). This article reviews the past and present of VE and current trends, and projects VE's role in defense economics of the 1970s. The discussion is based largely on the results of recently completed comprehensive top management review of the DOD Value Engineering Program.

Past and Present

VE began largely as a "grassroots" movement, initiated by engineers who recognized the need for a systematic approach for reducing the costs of products, both commercial and military.

While it has gained increasing recognition in both the Defense Department and industry in the past 15 years, today even its most avid disciples would concede that many VE programs are at best lip-service efforts maintained by management for "image" purposes. It has not yet gained full acceptance among management and line personnel as a methodology useful for attacking high cost areas. Its contractual provisions in the Armed Services Procurement Regulation (ASPR) are frequently ignored by contractors or circumvented by DOD program managers and contracting officers. It is widely regarded as an unwelcome and bothersome burden by overworked management, technical, and procurement personnel. Some people even regard it as an invidious scheme to unjustifiably enhance contractor profits. It would, therefore, seem to some that VE, like many managerial fads, is destined to fade away in the 1970s.

However, let's review progress. VE accomplishments are surprising in their productivity. Since FY 1963, almost $8 billion in audited VE savings have been reported in the DOD Cost Reduction Program. In terms of growth, in FY 1963 VE represented



*Cost reduction reporting system revised effective FY 1967 to report estimated savings for current fiscal year and up to two ensuing years from current year actions.

Figure 1.

about 10 percent of the Cost Reduction Program. It increased to about 25 percent in FY 1968. Figure 1 illustrates growth from FY 1963 to FY 1969. Most of these savings originated internally within the DOD.

Benefits which industry and DOD receive from industry VE activity can occur in four ways:

• Contractors use VE to lower initial bids. Savings of this type are, of course, impossible to measure.

• Contractors use VE to generate cost reduction changes which do not require a contract change. Although DOD does not benefit immediately in this case on fixed price contracts, this effort usually results in lower future contract prices. Contractors participating in the DOD Contractor Cost Reduction Program report about $200 million in such savings each year.

• Contractors generate savings under DOD-funded Value Engineering Program Requirement clauses. There are currently about 80 such funded program clauses in existence, generating about $150 million in savings each year. There will probably be more emphasis on the use of such program clauses in the future.

• Contractors generate savings under VE incentive clauses. These are savings frequently called Value Engineering Change Proposals (VECPs).

Since FY 1965, over 4,500 VECPs, worth an estimated one-quarter billion dollars to DOD, have been approved. The contractor has averaged about 25 cents in augmented income for each dollar saved during the sharing period. Over this period of time, the approval rate has varied between 50 and 60 percent. Perhaps even more important is the trend. Last year, estimated savings to DOD increased by 64 percent to over $84 million. The number of VECPs approved reached 1,221, the first year that more than 1,000 VECPs were approved. The number of hi-dollar (over $50,000) VECPs also increased. During the last fiscal year, for example, 19 approvals worth over $1 million were made. One of these was worth an estimated $22 million, with the contractor receiving an estimated $3.9 million as his share.

The record shows that contractors who have applied VE to their contract performance are reaping benefits. The DOD VECP report shows this record for five defense contractors over three fiscal years:

• In FY 1967, 38 VECP approvals resulted in savings of $5.65 million for the five contractors, $1.14 million average savings for each contractor, and $12.1 million savings for DOD.

• In FY 1968, 51 VECP approvals resulted in savings of $9.6 million for the five contractors, $1.92 million average savings for each contractor, and $16.7 million savings for DOD.

• In FY 1969, 71 VECP approvals resulted in savings of $14.7 for the five contractors, $2.94 million average savings for each contractor, and $47 million savings to DOD.

These five companies have increased their hi-dollar approvals, with consequent increases in their share of the savings as well as the savings to DOD. It is interesting to note that these five contractors were responsible for over 50 percent of VECP savings to the DOD in FY 1969.

If more contractors were doing equally well, the savings to DOD and to industry would be several magnitudes greater. A Logistics Management Institute estimate of a $200 million potential in VE savings appears to be very conservative.

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Two Examples

One example of VE improvements concerns the minigun, an airborne machine gun produced by the General Electric Co.'s Aircraft Equipment Division, Burlington, Vt. The facts of this case were presented by W. F. Kurth of General Electric at a DOD-Industry VE Conference at Gaithersburg, Md., in December 1969.

During the period of 1965 through 1969, 73 VECPs were approved on this gun. The contractor's share of the savings from these VECPs is estimated to be $1,577,000, while the DOD share of the savings is about $4,653,000. Upon completion of the sharing period, moreover, DOD retains all of the future savings.

Reliability also improved markedly. Reliability (mean rounds between failures) increased from 47,000 rounds to 650,000 rounds. These figures include only VECPs and failures on the gun, and are based upon firing of approximately 73 million rounds.

A concurrent improvement in maintainability was achieved based on the cost of firing a single round. A study was based on:

• Five hundred rounds fired.

• Actual gun costs in 1965 and 1969.

Rudy H. Kempter is Deputy Director for Value Engineering, Office of Assistant Secretary of Defense (Installations and Logistics). Before joining the Office of the Secretary of Defense, he served as a program manager with the Navy.

• Gun life as designed in 1965 versus estimated life in 1969. (Estimated gun life has grown from 100,000 rounds in 1965 to 500,000 in FY 1969. Several guns have exceeded 7.5 million rounds.)

• Spare parts usage as defined in technical orders in 1965 and the costs of these parts.

The cost to fire a single round decreased from 3.7 cents to approximately 0.5 cents during the period that the 73 VECPs were approved.

A second case was discussed by Dr. N. I. Hall, Vice President of Hughes Aircraft Co., at the Air Force Systems Command-Industry VE Symposium at the Air Force Academy in September 1969.

Figure 2 shows Hughes Value Engineering Change Proposal activity since March 1964. Prior to that date, VE cost reduction results were achieved on non-contractual (Class II) changes. VE activity on two of these programs, the Phoenix and Maverick missiles, are of particular interest.

The Phoenix program had a Value Engineering Program Requirement clause with a 75/25 share pattern in research, development, test and evaluation, and an 80/20 share pattern for production of the first 89 missiles. The Navy's objective was to reduce the cost of the missile by 33 percent. The development phase has recently been completed with a 37-percent net reduction in costs for initial production of 89 missiles. After the cost of the VE program is deducted, the net decrease in cost is $7.7 million. Many of the VE changes resulted in improvement and simplification of design in such a way that reliability was increased by 30 percent, weight was reduced by 11 pounds per missile, maintainability was improved, and power requirements were reduced. Such results are not uncommon with proper application of the VE discipline.

The VE program on the Maverick missile is of particular interest since it was conducted with performance/design specifications, rather than detailed end item hardware configuration specifications.

Thirteen of 21 VECPs already approved relate to software portions of the contract—data items, reports, displays, including five modifications of test requirements. This is in sharp contrast to the better known hardware type of VECPs stressed on most programs, and illustrates that VE potential exists on performance type specification contracts as well as on those contracts with detailed design requirements.

The Future

To see the possible future of VE application, we need to examine the general environment within which VE will live, the assets VE possesses for serving management needs during the 1970s, and current VE trends.

Factors in the general and overall management environment which will affect VE are:

• Greater concern over defense costs.

• Continued growth in our technology development.

The first factor is manifested in numerous ways, but perhaps most importantly in changing Congressional attitudes. These attitudes, in turn, create a greater need within the De-

Hughes Aircraft Co. VECP Activity

March 1964–January 1970

Program	Number of VECPs Accepted	Hughes' Share (Earnings) Instant	Follow-on	Total	Customer Share (Savings)
Minuteman Electronics	5	$168,600		$168,600	$253,400*
Interceptor Improvement	7	671,000		671,000	821,000
MA-1 Fire Control System	1	11,400		11,400	11,400
AIM-4D Missile	6	859,500		859,500	859,500
Walleye Missile	2	43,600		43,600	43,600
HS 308 Satellite	1	6,400		6,400	6,400
407L Operation Centers	2	133,000		133,000	133,000
Sensor Reporting Post	3	81,000		81,000	81,000
Modems	1	6,700		6,700	60,300
Mark I B	1	18,600		18,600	18,600
Maverick Missile	21	389,100	$678,200	1,067,300	2,490,300
TOW Missile	22	160,400	425,000	585,400	1,306,200
Phoenix Missile	30	168,300	1,260,000	1,428,300	6,300,000
TOTALS	102	$2,717,600	$2,363,200	$5,080,800	$12,384,700

*Hughes subcontract from The Boeing Co.

Figure 2.

fense Department for management use of VE to stretch scarcer DOD resources.

The second factor also favors continued survival of VE. To a large degree, VE could simply be defined as an economically advantageous technical change. As science and technology grow, so does the VE opportunity. Thus, both the management need and technical base for VE seem favorable for increased use in the 1970s.

VE has formidable assets. It has definition, policy, directives, procedures, methodology, handbooks, contract incentives, people, a technical society, and an evolving management approach. At the level at which it performs best, VE has no existing competitors. Systems analysis and cost effectiveness operate at higher levels. Industrial engineering focuses on manufacturing, primarily. Standardization complements, rather than competes with it. If management sees a need for something like VE, it therefore seems logical to build upon an existing base than to start from scratch without nothing.

From a management approach to VE programs, what are some trends within DOD? We stated earlier that one of the stumbling blocks to earlier progress was lack of effective approach to the integration of VE into the mainstream of activity. We now appear to be approaching general agreement to the solution of this problem. The old picture of VE as a small group of people independently "second-guessing" production items is a "Model T" version that is now largely passé. The current trend in industries with successful programs has the VE group operating, not as a second guesser or competitor, but as a staff and catalytic agent. Value engineers assist line and program management in achieving goals delegated from top management. Resources are allocated specifically to find VE opportunities by reviewing high cost areas, by questioning specifications, by applying new advances in technology, and by searching for possible economies due to changes in the user's needs or new knowledge gained in feedback from test or use. These can be spotted most easily by line personnel familiar with the item at hand, provided they are motivated and trained to look for them.

In the current approach to VE, management sets goals to motivate widest possible participation by line and program management personnel. Management also allocates training and resources to provide the skills and tools necessary for these personnel to perform effectively.

This is the direction in which the DOD Value Engineering Program is moving today.

No discussion of this sort would be complete without an assessment of potential. A viable DOD Value Engineering Program during the 1970s should be capable of saving the Defense Department a billion dollars in resources each year. This figure may seem startling at first glance, but a close inspection of the potential versus current achievements makes this a realistic estimate. It is based upon VE savings inhouse, use of VE program requirement clauses, contractor-initiated Value Engineering Change Proposals, and savings from contractor Class II type VE changes.

The Value Engineering Program stands today at the threshhold. The severely limited economics of defense dictate growing management need for a program of this sort.

If management more widely recognizes emerging VE success patterns, VE will be a "billion dollar baby" in DOD during the 1970s.

NAVAIR Relocated

The Naval Air Systems Command has completed the move of its personnel from the Navy Department ("Main Navy") and Munitions Buildings on Constitution Avenue, Washington, D.C., to the new Jefferson Plaza office buildings on Jefferson Davis Highway, Arlington, Va., just south of the Pentagon.

The mailing address of Naval Air Systems Command offices is not changed (Office Name, Code, Naval Air Systems Command, Navy Department, Washington, D.C. 20360). Information on telephone numbers may be obtained by calling (202) OXford 7-0111.

The working hours of personnel at Jefferson Plaza have been set at 7:15 a.m. to 3:45 p.m.

AFA Annual Convention, Briefings and Displays Set for September 21–24

The Air Force Association (AFA) 1970 National Convention, now combined with its Aerospace Development Briefings and Displays, will be held at the Sheraton Park Hotel, Washington, D.C., September 21–24.

The convention program includes a luncheon on September 22 honoring General John D. Ryan, Air Force Chief of Staff, at which he will be the principal speaker. A luncheon on September 23 will honor Secretary of the Air Force Robert C. Seamans Jr., at which he will deliver the principal address. Other features of the program are an Air Force Reserve Seminar on September 22 and an Air Force Symposium covering the threat to national security on September 23. A reception and banquet, observing the 23rd anniversary of the Air Force, will close the convention on the evening of September 24.

The Aerospace Development Briefings and Displays will be held September 22, 23 and 24. More than 50 companies will present the latest aerospace and defense systems and equipment. The program combines displays of equipment with company presentations in individual booths on a scheduled basis. Morning attendees are escorted to each briefing in the group selected. Afternoon attendees may select any of the briefings offered in any order of preference.

This year's briefings will include presentations on the B-1 aircraft, rocket propulsion, communications, avionics, advanced composites, laser fire control, navigation, engine development, V/STOL, and other timely developments.

ESD Communications Deputate Moved

The Deputate for Communication Systems, Electronic Systems Division, Air Force Systems Command, has moved from the Waltham, Mass., Federal Center to Building 1618 at L. G. Hanscom Field, Bedford, Mass.

Colonel Robert J. Kuehn is Deputy for Communications Systems.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Vice Adm. John V. Smith, USN, has been named Commandant, Industrial College of the Armed Forces.

Raymond G. Leddy has been designated Dir., Military Assistance and Sales, Office of the Asst. Secretary (International Security Affairs).

Recent assignments in the Defense Supply Agency include: **Brig. Gen. John S. Chandler**, USAF, Commander, Defense Contract Administration Services Region, Los Angeles, Calif.; **Brig. Gen. (designee) Paul E. Smith**, USA, Commander, Defense Industrial Supply Center; and **Col. Claude G. Baughman**, USA, Commander, Defense Industrial Plant Equipment Center, Memphis, Tenn.

DEPARTMENT OF THE ARMY

Maj. Gen. (selectee) James G. Kalergis is the new Dep. Commanding General for Logistics Support, Army Materiel Command. Replacing Gen. Kalergis in his former position as AMC Comptroller is Brig. Gen. (selectee) Hal E. Hallgren.

Brig. Gen. Herbert J. McChrystal Jr. has been designated Dir., Force Planning Analysis, Office of Asst. Vice Chief of Staff.

Brig. Gen. Ralph Richards Jr. is now the Chief of Finance and Accounting, Office of the Comptroller of the Army.

Brig. Gen. Elmer P. Yates has been named Dir. of Installations, Office of Dep. Chief of Staff for Logistics, Dept. of the Army.

Brig. Gen. (selectee) Dean Van Lydegraf has assumed command of the U.S. Army Natick Laboratories, Natick, Mass.

Dr. John L. McDaniel has been named Dir. of Research and Engineering, Army Missile Command, Huntsville, Ala.

Col. William C. Ohl has been designated Commander, Army Materiel Command Field Office, Sandia Base, Albuquerque, N. Mex.

Two new assignments within the Corps of Engineers are: **Brig. Gen. John W. Morris**, Div. Engineer, Missouri River Div., Omaha, Neb.; and **Col. Richard M. Connell**, District Engineer, Walla Walla District, Walla Walla, Wash.

DEPARTMENT OF THE NAVY

Vice Adm. J. D. Arnold will perform the duties of Chief of Naval Material and Commander, Naval Materiel Command. He replaced Adm. I. J. Galantin, who has retired. Other new assignments within the Naval Materiel Command are: **Rear Adm. Kenneth R. Wheeler**, Commander, Naval Supply Systems Command and Chief of the Supply Corps; **Rear Adm. Wallace R. Dowd Jr.**, Vice Commander, Naval Supply Systems Command; **Rear Adm. Robert L. Baughan Jr.**, Vice Commander, Naval Ordnance Systems Command; and **Capt. Walter R. Fraser**, Dir., Photographic Div., Naval Air Systems Command.

Rear Adm. Ernest E. Christensen has been named Asst. Dep. Chief of Naval Operations (Development).

Rear Adm. William M. Harnish has been designated Dep. Naval Comptroller, Department of the Navy, and Rear Adm. Sam H. Moore has been named Dir. of the Budget and Reports, Office of the Naval Comptroller.

Rear Adm. Carl Q. Holmquist is the new Chief of Naval Research, Washington, D.C.

DEPARTMENT OF THE AIR FORCE

Lt. Gen. (selectee) Richard H. Ellis will be assigned as Vice Commander in Chief, United States Air Forces, Europe, effective Sept. 1. He will replace Lt. Gen. George B. Simler, who will become Commander, Air Training Command, Randolph AFB, Tex.

New assignments in Hq., USAF, are: **Maj. Gen. Carlos M. Talbott**, Dir. of Operations, Office of Dep. Chief of Staff, Planning and Operations; **Brig. Gen. Jonas L. Blank**, Dir., Supply and Services, Office of Dep. Chief of Staff, Systems and Logistics; **Brig. Gen. Theodore S. Coberly**, Dir. of Reconnaissance and Electronic Warfare, Office of Dep. Chief of Staff, Research and Development and **Brig. Gen. (selectee) John J. Burns**, Dep. Dir. for General Purpose and Airlift Forces, Office of Dep. Chief of Staff, Research and Development.

In Air Force Systems Command, **Maj. Gen. Paul T. Cooper** has been named Dir. of Laboratories, Hq., AFSC. He replaced **Brig. Gen. Raymond A. Gilbert**, who has retired.

Other new assignments in AFSC include: **Maj. Gen. John B. Hudson**, Vice Commander, Aeronautical Systems Div., Wright-Patterson AFB, Ohio, (previously reported for reassignment as Vice Commander, Space and Missile Systems Organization, Los Angeles AFS, Calif.); **Maj. Gen. Clifford J. Kronauer**, Chief of Staff, AFSC (previously announced to be Dep. Chief of Staff, Operations); **Maj. Gen. Edmund F. O'Connor**, Dep. Chief of Staff, Procurement and Production, replacing **Maj. Gen. Fred J. Higgins** who retired; **Brig. Gen. Louis O. Adler**, Dep. Chief of Staff, Comptroller; **Brig. Gen. Warner E. Newby**, Systems Program Dir., C-5A, Aeronautical Systems Div., Wright-Patterson AFB, Ohio; **Brig. Gen. Alton D. Slay**, Dep. Chief of Staff, Operations; **Brig. Gen. (selectee) Abner B. Martin**, Dep. for Re-Entry Systems, Space and Missile Systems Organization, Norton AFB, Calif.; and **Brig. Gen. (selectee) Robert M. White**, Commander, Air Force Flight Test Center, Edwards AFB, Calif.

Maj. Gen. George J. Keegan Jr. will become Dep. Chief of Staff, Plans and Operations, Air Force Logistics Command, Wright-Patterson AFB, Ohio, effective Aug. 25.

Contract Awarded for New Class Destroyers

The Navy has awarded a $2.14 billion contract for construction of 30 multi-purpose destroyers to Litton Industries, Inc.

The fixed-price incentive, multi-year contract provides for funding the ships in five consecutive annual procurement increments, each subject to Congressional approval. The first increment of $214 million for three ships was funded last year. The second increment, for six ships, is now before Congress. Total eventual cost to the Government, including cost of government-furnished radars and weaponry, is estimated at $2.55 billion.

Formerly known as the DX or DD-963, the first ship in the new class will be named in honor of the late Admiral Raymond A. Spruance. Delivery is expected in the fall of 1974.

The Spruance class destroyers will be the first ships designed and manufactured under the concept formulation/contract definition/multi-year acquisition process, in which design and construction is managed by a single firm. Six major U.S. shipbuilders were in the initial competition in 1968. Competing with Litton Industries, Inc., in the final stage was Bath Iron Works Corp., Bath, Maine.

The Spruance class destroyers will be built at the new west bank facility of Litton's Ingalls Shipbuilding Division, Pascagoula, Miss. More than 60 percent of the dollar value of each ship will be used to purchase materials and equipment from subcontractors in 45 states.

The Maritime Administration has certified the company as being in compliance with the equal employment opportunity requirements of Presidential Executive Order 11246 and Order Number 4 of the Federal Contract Compliance Office of the Department of Labor.

The Spruance class is the first general purpose destroyer construction program since the late 1950s. It will be the backbone of the Navy's destroyer force in the 1970s and beyond.

Four gas turbine engines will power each destroyer to speeds in excess of 30 knots. The 559-foot 11-inch ship will have a 54-foot beam, and will displace 7,000 tons.

Primary mission of the destroyers is antisubmarine warfare. They will also have capability for shore bombardment and surface warfare. They will be armed with two 5-inch guns, Seasparrow missiles for defense against airborne threats, standard and rocket-assisted projectiles, and antisubmarine torpedoes and rockets. Sensors will include air and surface search and fire control radars, long range sonar, and electronic warfare equipment. The ships will be equipped with an underwater surveillance and communication system to detect, track and classify targets. They will have a unique combat information center, a centralized location with all informa-

tion and displays to command the ship's full weapon system capability.

Effectiveness against submarines is expected to be far greater than that of current ships, particularly at high speeds, due to ship silencing techniques and improved seakeeping capabilities. The ships will be equipped to operate manned helicopters, which will extend antisubmarine attack capability and electronic warfare detection beyond the horizon.

Other missions include escort for military and merchant convoys, surveillance and trailing, blockade, and search and rescue.

The form of the ship's hull was designed to minimize roll and pitch of the ship at sea, thus achieving highest accuracy of the weapon systems. The hull design also reduces resistance and drag of the ship in the water, resulting in fuel savings at high speeds.

Each new destroyer will be manned by 270-man crews, less than required for a conventional destroyer of similar size and lesser capability. Crew reduction was made possible by using materials requiring minimum maintenance and by maximizing automation in propulsion and electrical systems. For example, one man at the ship's console controls steering and speed. Reduction in crew size will result in operating cost savings of $500,000 annually.

Conventional and regulatory standards for crew comfort and habitability have been exceeded. Living areas are sound insulated and located near midship, away from noise producing machinery. The midship location also minimizes crew exposure to ship motion. Berths are arranged in groups, with partitions, lockers and recreational tables forming "buffer zones" and creating maximum privacy. Sanitary facilities and recreational areas are located near each berthing group. The messing complex is also centrally located. Two independent main passageways allow easy and rapid movement of traffic with minimum disturbance to sleeping personnel.

Incorporated into the design of the destroyers are systems that will reduce water and air pollution. An electromechanical shipboard sewage treatment plant will process waste by separating and incinerating solids and chemically treating liquids. Existing passive methods collect waste in tanks for offloading into barges in port.

The destroyers will reduce oil pollution by collecting waste lubricants and oil in storage tanks for discharge in port into barges or a shore facility. The gas turbine engines operating on Navy distillate fuel will reduce soot in smokestacks and black smoke emissions into the air while in operation.

Litton Industries will assist the Navy in teaching new crews to operate the ships, and will develop texts and training aids for new and modified equipment.

Remote Weather Station Air-Dropped, Expendable

A $320,000 contract has been awarded by the Air Force Cambridge Research Laboratories to Honeywell's Aerospace Division in Florida for the development of an Expendable Remote Operating Weather Station (EROWS) for use by the Air Weather Service. Designed to be dropped in remote, inaccessible areas, the weather station is cylindrical, about 8 feet long and 6 inches in diameter, and weighs 55 pounds. Dropped from an aircraft, it is stabilized and descends to the ground on four rotating blades, each 2.5 feet long. A spear-like tip imbeds itself in the ground and a 5.7 foot vertical dipole antenna is automatically raised into position.

A 4-pound sensor package near the top gathers data about wind speed and direction, atmospheric pressure, temperature, humidity, precipitation, and cloud cover. The data is then transmitted through FM telemetry equipment to a master control station, capable of handling 10 EROWSs. The master station will include an interrogation module to display the exact status of the EROWS being sensored, and will be able to perform a remote checkout of the EROWS.

Final unit cost of the EROWS is estimated to be in the $1,000 range.

The Netherlands Join NATO Seasparrow Missile Program

The Netherlands has become th fifth NATO country to join th NATO Seasparrow Project, a cooper ative development program designe to produce a second generation poin defense antimissile weapon system.

Originally set up among Denmark Italy, Norway and the United States the initial contract for development of the Seasparrow Surface Missile System was issued in September 1969.

Participating countries share the development costs in proportion to the number of subsystems each acquires for use. This cooperative effort is expected to benefit participants through pooled research and development efforts. Each nation will be furnished a complete production data package and a share in the production.

The development contract calls for three engineering and development models, complete with all supporting equipment, spare parts and documentation. One system will be tested by the U.S. Navy, one will be delivered to Norway for operational testing, and one will remain at the contractor's plant for systems evaluation.

Overall control of the program resides in a board of directors, consisting of a senior representative from each country and called the NATO Seasparrow Project Steering Committee. Voting power of each member is in direct proportion to his country's development cost share. Changes of major impact require unanimous consent.

The NATO Seasparrow Project Office, opened in Washington, D.C., in July 1968, is headed by a project manager, with representatives from each participating country. The Naval Ordnance Systems Command acts as support for the office on contracts, legal services, security and some administrative areas.

The Seasparrow system is designed to be used against hostile aircraft, missiles and surface targets. It consists of a combination illumination and target-tracking radar, and Sparrow missiles stored in and fired from celltype launchers. Digital computation will be used in solving fire control problems.

A Market for Small Business

Individually and collectively, small business concerns contribute indispensably to America's security and economic well-being. Congress has declared the policy that Government shall aid, counsel, assist and protect the interests of small businesses.

One area of special interest to many small business firms is subcontracting. Defense producers holding individual orders of $500,000 or more are contractually obligated to establish and conduct formal small business subcontracting programs. Large contractors agree to make available opportunities for small business to compete for subcontracts and orders generated by prime contract production.

The Defense Contract Administration Services (DCAS) of the Defense Supply Agency administers about 210,000 prime contracts worth $50 billion held by more than 20,000 firms. About 50 percent of the average contract face value is expended on subcontracts for materials, parts and services. Of the amount subcontracted by DCAS-assigned prime contractors, about 47 percent is awarded to small businesses.

A small business advisor in each DCAS region or district is responsible for assuring that prime contractors comply with their obligation to small business. These advisors accumulate valuable leads on purchasing requirements in their respective areas through close working relationship with prime contractors. These leads and production information are passed on to small business firms in an effort to increase and strengthen small business participation in military contracting.

Directories containing names and product lines of principal prime contractors are published as marketing aids for potential subcontractors. Readers are encouraged to solicit the counsel, assistance and advice offered by the nearest DCAS small business advisor.—**Lloyd C. Alderman, Assistant Small Business and Labor Surplus Advisor, Defense Contract Administration Services, Defense Supply Agency.**

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PROGRAM REFINEMENT OF MATERIEL ACQUISITION PROCESS 70

Major General
Paul A. Feyereisen, USA

The Defense Department is currently faced with strong pressure to reduce personnel strengths and spending. Public scrutiny is being focused on military spending more intensely than at any time in our country's history. The Armed Forces are required to reduce their force structure while still heavily involved in hostilities in Southeast Asia. Such is the environment of the government contracting marketplace in 1970.

The Army Materiel Command (AMC) will face up to this environment by positively confronting its challenges, rather than by being defensive of the past. The requirement "to do more with less" is being translated into an opportunity. AMC is exploiting this opportunity with the Program for the Refinement of the Materiel Acquisition Process—PROMAP-70.

PROMPAP-70 is an outgrowth of a memorandum issued by Deputy Secretary of Defense David Packard on July 31, 1969, in which he focused attention on the problems associated with weapon system acquisition. In this memorandum, addressed to the Secretaries of the Army, Navy and Air Force, he outlined five general areas that needed improvement:

- Excessive optimism in cost estimates.
- Control of changes in on-going programs.
- Comprehensive assessment of risk prior to system development.
- Use of competitive prototypes in developments.
- Concurrent development/test and evaluation.

AMC recognizes that frequently the Army simply has not been receiving what has been asked for from industry, and has been paying too much for what it has received. The fault lies exclusively with neither the Government nor industry. In many cases, the Army has failed to adequately analyze and to define its requirements for industry. Contractors have failed to control their resources adequately. Both the Army and industry have been excessively optimistic in estimating project costs.

The primary objective of PROMAP is to improve all areas of acquisition management. Emphasis is being placed on concrete payoffs, rather than devising new procedures and publishing new regulations. The materiel acquisition process will be looked at on a before-and-after basis in an attempt to discover opportunities to improve the overall system. The 5 broad problem areas, identified by Secretary Packard, have been divided into approximately 50 manageable tasks, each headed by a senior staff member in AMC.

PROMAP Approach

PROMAP—70 is using the current command and staff relationships which exist among the Secretary of the Army, the Army Chief of Staff, and the Army Materiel Command. AMC operating levels will be doing the majority of the program development, since major subordinate commands and separate project managers assign task directors to applicable tasks. The people who will be executing the changes are the ones involved in determining what needs to be changed.

AMC major subordinate commands, called commodity commands, are responsible for the grass roots development and implementation of PROMAP-70. The eight commodity commands are:

- Aviation Systems Command, St. Louis, Mo.
- Electronics Command, Fort Monmouth, N.J.
- Missile Command, Huntsville, Ala.
- Mobility Equipment Command, St. Louis, Mo.
- Munitions Command, Dover, Del.
- Tank-Automotive Command, Detroit, Mich.
- Test and Evaluation Command, Aberdeen Proving Ground, Md.
- Weapons Command, Rock Island, Ill.

Each of these organizations is developing all the PROMAP tasks which apply to the respective command. With most of the tasks, the commodity commands must coordinate their efforts so that an overall AMC position is established, applicable throughout the Army. In many instances, the commands will be working with industry representatives in developing acquisition improvements

in the business-government contracting interface.

PROMAP Tasks

The best way to describe exactly what the PROMAP-70 tasks entail is to look at each problem area defined by Secretary Packard, and discuss it in relation to PROMAP. The chart on pages 20 and 21 depicts how each PROMAP task fits into the materiel acquisition phases of the life of the weapon system.

Excessive Optimism in Cost Estimates. Government statistics indicate that the largest single cause of cost growth in materiel acquisition is over-optimism in cost estimates for major weapon systems. Much of this results from the tremendous competition for programs among contractors. In some cases it is also a product, with the military services, of competition among programs for limited financial resources.

Major General Paul A. Feyereisen, USA, is Deputy Commanding General for Materiel Acquisition of the Army Materiel Command. Before assuming this position, he served at AMC headquarters as Director of Materiel Requirements. In 1966, General Feyereisen was named U.S. Program Manager for the MALLARD Project, and later was given additional duty as Deputy Commanding General of the Army Electronics Command for Tactical Communication Systems. He is a graduate of the University of Minnesota, Harvard University School of Business Administration, and the National War College.

To change this situation, defense contractors must come to grips with the need for cost realism in their proposals. In turn, the Government must make cost realism a major factor to be considered in source selection. To accomplish this end, it is incumbent upon the Government to make a distinct improvement in its cost estimating and validating capability, as well as to ensure that this estimating capability is fully and effectively applied by the source selection authority.

Nine of the 60 PROMAP tasks address themselves specifically to improved cost estimates. Actual pilot weapon systems will be studied to aid in improving documentation and cost estimating methods. With improved documentation and estimating methods, the Army can arrive at independent, realistic forecasts prior to commitment to a single course of action. The Army will develop "should cost" estimates not only to enhance its negotiating position, but also to point up ways in which contractor operations can be improved. PROMAP will establish milestones in the acquisition cycle of programs at which a consolidated recomputation of the cost estimate will be made. If at any time the cost estimate exceeds a pre-established threshold, an in-depth appraisal of the program risks and status will follow.

Control of Changes in On-going Programs. Changes made in a program, during both the development phase and the production phase, are also major contributors to cost growth. Improvements in this area can be achieved by:

- Ensuring complete, specific definition by the Government of what is needed in a system before beginning full scale development.
- Vigorous review and elimination of the many "nice" or "desirable" features which so often creep into major systems as they proceed through development and production.

The greatest cost impact of changes is from unpriced change orders, since their cost is not negotiated during contract performance. While the ideal solution would be prohibition of any unpriced changes, this is not practical in the majority of cases. PROMAP tasks, therefore, will seek to increase control over the approval of changes and ensure that their total system impact is properly evaluated.

A Configuration Control Review Board is being established at AMC headquarters to ensure adequate evaluation of major engineering change proposals. A Change Control Center is also being established at one of AMC's commodity commands. This will be a pilot test to determine desirability of its application throughout the Army Material Command. The Change Control Center will evaluate proposed engineering changes in terms of cost, schedule, and technical impact, and will provide command level visibility to all changes. One PROMAP task is designed to identify each over-age change order in excess of $10,000 to determine the cause of delay and to establish, in coordination with the commodity commands, a realistic, time-phased plan for finalization.

Comprehensive Assessment of Risk Prior to System Development. There is a need to better identify risks associated with major programs and to do a thorough job in completing prerequisites to contract definition. Failure to do this can result in disruption of schedule and increase in program cost. Risk analyses should be made when developing Qualitative Materiel Requirement/Qualitative Materiel Development Objectives documents,[1] and during each succeeding stage of the acquisition process—contract definition, source selection, engineering development, and production.

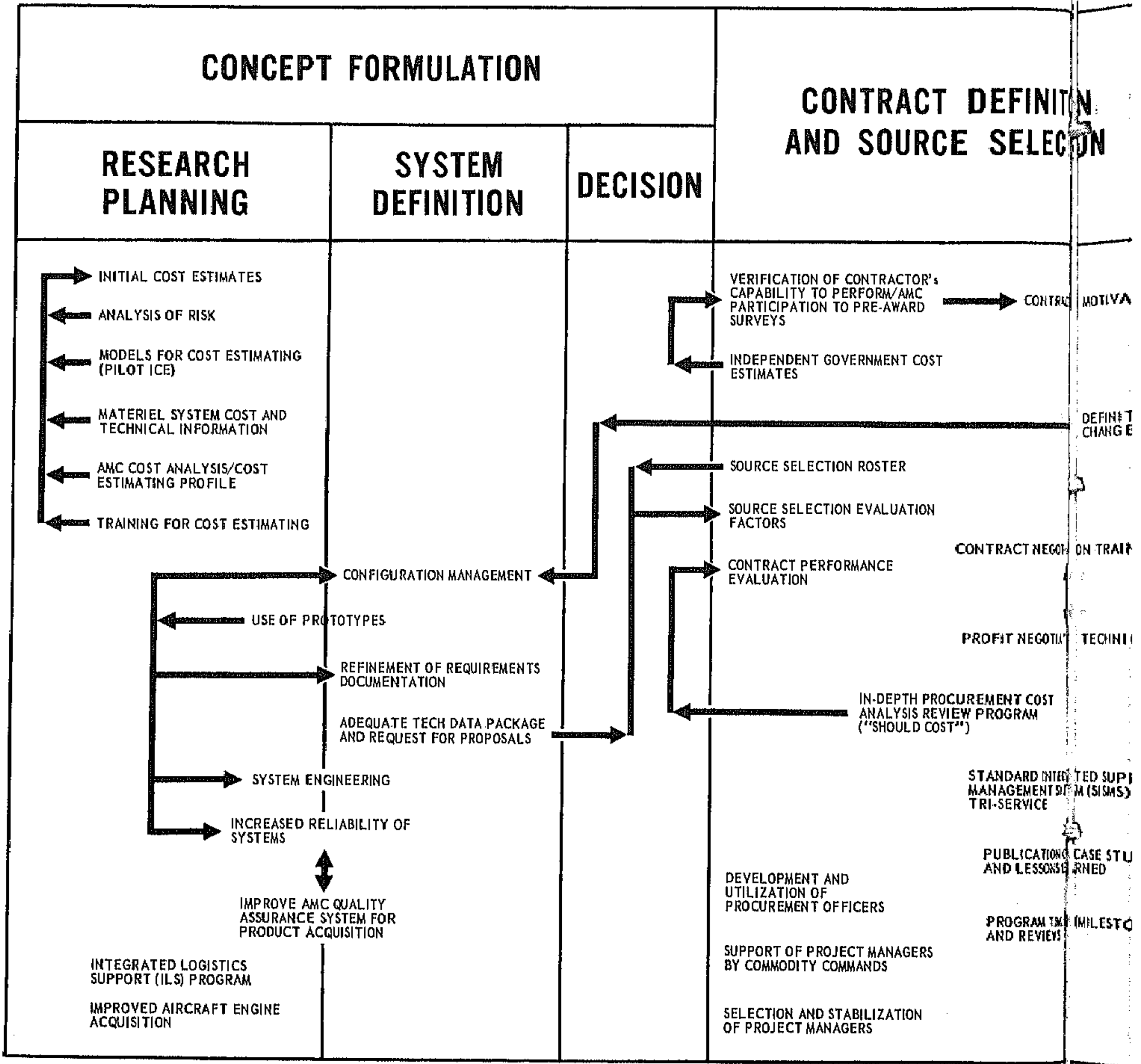
One PROMAP-70 task has been designed to use prototype demonstration, when feasible, to analyze technical risk. Prototype demonstration would provide valuable cost and technical risk information *prior* to final source selection. Such information would preclude a prospective contractor from submitting an unrealistically low cost proposal for system development and production.

[1] *Qualitative Materiel Requirement/Qualitative Materiel Development Objectives (QMR/QMDO) are Army documents indicating military requirements and performance objectives which the combat developer needs. From these documents, the materiel developer translates requirements into new acquisition projects.*

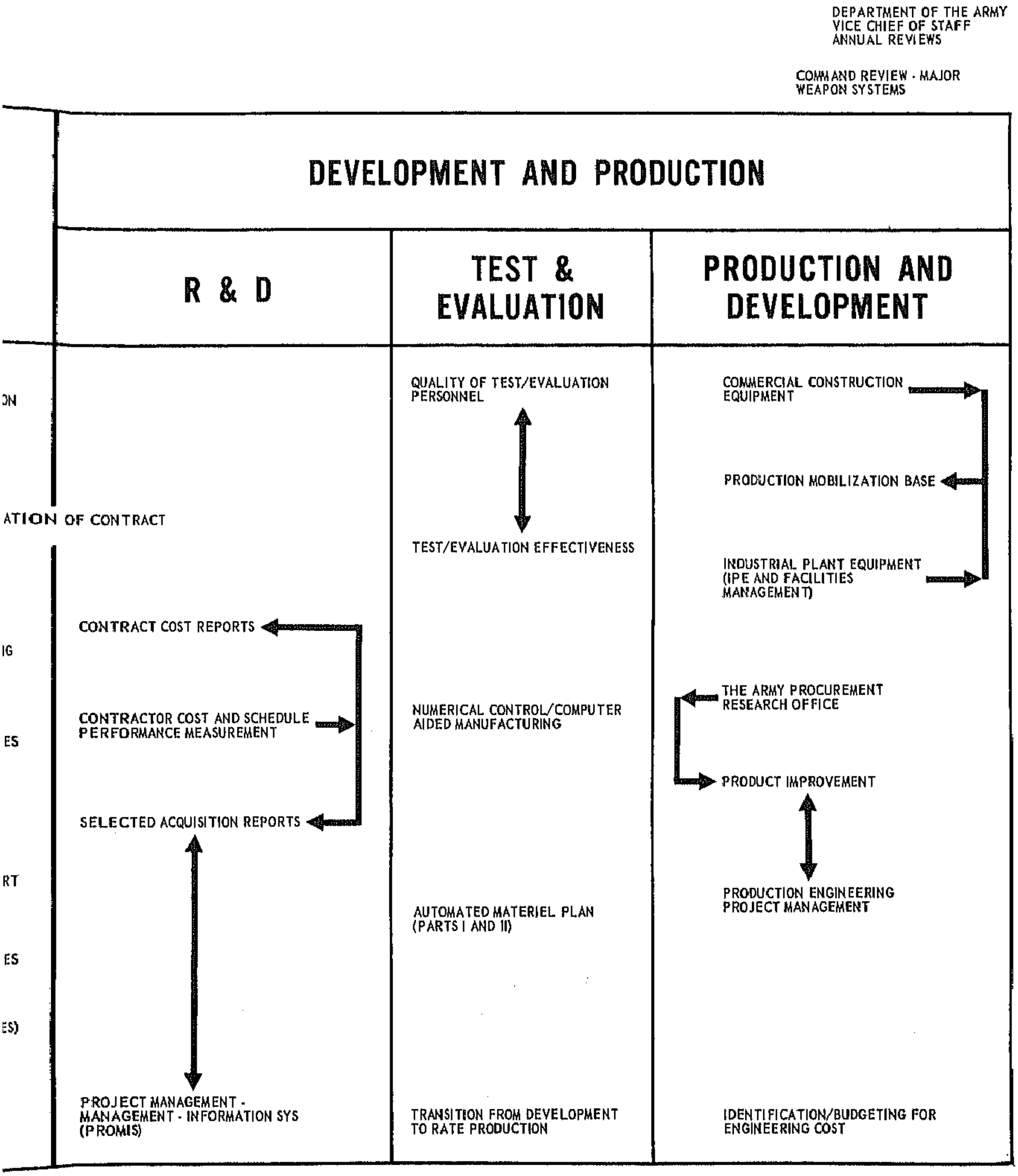
PROGRAM FOR THE REF
ACQUISITION PRO

INTERNAL INFORMATION PLAN

REDUCTION OF NONESSENTIAL REPORTING IN AMC



ENT OF THE MATERIEL
(PROMAP - 70)



Another task has been set up to conduct reviews of risk and technical achievement periodically throughout the life of the contracts for a system. Still another will establish a procedure to back up the development of high risk components by concurrent development of less sophisticated, low risk components. The idea behind all these efforts is to isolate the principal unknowns associated with a program, to develop a risk profile based on the unknowns, and to evaluate the alternative courses of action to offset the risk involved.

Analysis of risk ties in closely with excessive optimism in cost estimates, since realistic cost forecasts must explicitly account for the probability that the system will cost more (and in some cases less) than the best estimate, because of technical uncertainties.

Use of Competitive Prototypes in Development. In general, it is felt that the Army will benefit by increasing dependence on hardware demonstration and competition, and attain some corresponding reduction in dependence on paper analysis. This must be done with recognition of the differences in susceptibility of different types and sizes of systems to this treatment. Competitive hardware demonstration before commitment to full scale development should help ensure that:

- Feasibility studies are sound.
- System is reasonably well defined.
- Cost proposals are credible.

While competitive prototype demonstration will prolong the contract definition phase, it will also result in a briefer engineering development phase, fewer engineering changes during production, and fewer contingencies in the contract price.

PROMAP-70 tasks envisage applying this expanded contract definition to three forthcoming procurements—Armored Reconnaissance Scout Vehicle (ARSV), Mechanized Infantry Combat Vehicle (MICV), and Vehicle Rapid Fire System Successor (Bushmaster). Competitive contractors, after submitting a preliminary proposal for engineering development and production, will supply prototypes for evaluation. Based on the results of prototype tests and any required technical guidance, the contractors will submit revised proposals for development and production. The source selection authorities will consider both the revised proposals and the results of prototype testing in awarding the contract.

In those cases where prototypes of the entire system are not needed or prove to be too costly, the Army will conduct competitive tests of prototypes of critical major components.

Concurrent Development/Test and Evaluation. The quality of test and evaluation, performed on a developmental weapon system before commitment of significant resources for production, is another area in which improvement will be sought. PROMAP is developing a plan for changes based on these guidelines:

- Clear designation of responsibility and capability to review and monitor testing, test planning activities, and test results throughout the Army.
- Procedure for providing accurate, objective summaries and key data to all interested agencies, particularly in connection with in-process reviews and major milestone reviews.
- Policy which will extend test and evaluation to product improvement programs, as appropriate.
- Assurance of involvement in the test process of military user representatives at as early a date as practical before substantial production decisions are made.

The Army intends to more clearly compartmentalize the development and production phases of new weapon systems acquisition. To provide a more orderly and controlled transition, the Army will make use of production options in engineering development contracts, with the production decision keyed to major milestone reviews, *e.g.*, a review at completion of engineer and service tests. The intent here is that for some contracts, and subsequent to major milestone reviews, the developer will have the option to follow-on production of the item to provide a more orderly and controlled transition from development to production. Other producers will not be barred from competing for rate production work; this option is for limited production runs to facilitate transition and test various production alternatives.

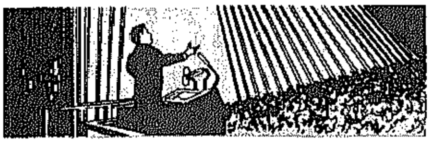
To ensure that the necessity to maintain contractor effort does not influence a hasty decision to produce, a development contract will include a priced option that permits deferring the production decision incrementally up to one year after the accomplishment of the engineering test/service test milestone. PROMAP will apply this technique to the development programs for the three major weapon systems previously mentioned—ARSV, MICV and Bushmaster—in order to evaluate their effectiveness and cost.

The foregoing discussion briefly describes AMC's plan to refine the materiel acquisition process. PROMAP began in January 1970. Many of its tasks have already developed new ways of doing business. For example, Army procedures and documentation used to develop materiel requirements underwent thorough study. As a result, a single requirements document was established to replace four previous documents. Processing time was reduced from 2½ years to 30 weeks. Also, new procedures were developed to allow for tradeoff considerations between operating requirements and technical design.

Another study was conducted to evaluate the Army's cost estimating capability. On the basis of its findings, AMC received authorization to increase the number of its cost estimating personnel from 530 to 780, and to establish 7 new cost data centers.

The Army has also conducted an in-depth procurement cost analysis review at Raytheon Co. to appraise the reasonableness of direct and indirect costs in proposals for the Improved Hawk missile. The results of this important "should cost" study had not been approved for release at the time this article was written.

PROMAP-70 is an ambitious program in that it is designed to get large numbers of people to change methods of operating, and to improve the overall materiel acquisition process. It is the Army Materiel Command's response to the Secretary of the Army's plan to improve the acquisition process. It is an excellent opportunity for the Army and its supporting contractors to do "more with less" in the decade of the 1970s.



FROM THE SPEAKERS ROSTRUM

Beyond the 1970s—What?

Address by Hon. Philip N. Whittaker, Asst. Secretary of the Air Force (Installations & Logistics), before the 1970 National Aerospace Electronics Conference sponsored by the Institute of Electrical and Electronics Engineers, Dayton, Ohio, May 18, 1970.

The role of prophet is an uneasy one . . . since it seems to imply some special wisdom and clairvoyance to which, most assuredly, I lay no claim. As a matter of fact, I have long admired Herbert Hoover's attitude toward prophecy—as he said, "Wisdom consists not so much in knowing what to do in the ultimate as in knowing what to do next."

I remember the closing comments of Secretary [of the Air Force] Seaman's speech to the Town Hall of California in Los Angeles last fall. He quoted a recent British Ambassador to Washington as remarking that man is a peculiarly constructed animal who can't read the handwriting on the wall until he has his back to it.

And then Secretary Seamans said, "I certainly hope that we will not find ourselves fitting this description. I also hope that our domestic needs and security requirements are met and satisfied with the dedication and industry that has always characterized America's endeavors. To do otherwise is to court disaster—with our backs to the wall."

That is a challenge. Let's see if we can read the handwriting on the wall for the 1980s.

More often than not we are too preoccupied with the present to look to the future. I think it is important, however, to look for a moment at the past in order to put the present and the future in perspective.

Do you realize the view of history we have from the vantage point of today?

About a million years ago man first inhabited this earth. The Age of Man began.

About 5,000 years ago the Egyptians began developing farming implements from the crude sticks that had, by then, been used for some 2,000 years, and the Age of Agriculture began.

Hand tools were replaced only about 170 years ago with powered machinery, and the Industrial Age began.

The emergence of electronics about the turn of this century was a precursor to the Scientific Age which began as long as 60 years ago and as recently as 40 years ago, depending on which expert is making the assessment.

From the nearsighted vantage point of time now, it is difficult to tell what is happening to us currently, but I suspect that we have already entered into a transitional period from the Scientific Age into a new Age.

As I'm sure we all agree, this 1970 time period is one of turbulence. As a time of change, it is the seedbed for the 1980s. In a recent article, Dr. John R. Everett, President of New York City's New School for Social Research, had this to say about the decade we are beginning:

> "The fundamental parts of the Reformation-born myth structure have started to crumble. The pace will be accelerated in the '70s by a technology that feeds upon itself, a discontent that feeds upon uncertainty, a communications system that shows us what we are before we can understand what we have been, and a frantic awareness that many of our intellectual and moral emperors have no clothes.

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> "From art to politics, from economics to family life, from religion to education and from love to hate, the institutional forms that define the bonds of the association of one American with another and with the world will be in increasingly rapid conflict during the '70s. The conflicts will be harsh and desperate. Never before has this nation approached a decade with such weakened faith in our religious and political institutions and our authority patterns. . . ."

These characteristics of the 1970s cause many problems in forecasting beyond the 1970s. Because of the turbulence, the waters are muddy and the vision unclear.

Change is occurring at an accelerating rate. You doubtless have seen charts showing the rate of change in our society based on speeds at which men travel, tool capacity, implements of combat, or one of a number of other such bases. They all start out gradually climbing until the present day when, in each case, the line goes almost straight up.

A plot of population growth follows the same pattern. For all time up to now, the world population has risen to some 3 billion people. In the next 30 years, this world population will double to 6 billion people. This means certainly that many more people are going to be older and younger. The social setting will be affected.

The increase in life span and the increased number of elderly will bring special problems of health care and the need to keep such people occupied and a contributing part of society.

The youth, on the other hand, bring vibrant, living problems. They question everything. Nothing is sacred. They certainly are questioning the wisdom, the processes and the responsiveness of Government and with even more fervor than is normally done every two and four years. The conscience and the motivations of business enterprise, especially big business, have been laid bare to the scrutiny of youth. Organized labor has come in for its share of criticism and debate. In fact, organized labor, the traditional revolutionary, has found that its act has been stolen by youth. Even religion is being challenged to a new reformation.

The *nature* of the *structure* of our *society* is becoming increasingly important. What ties it together—how? It might be compared with an electronic system with several circuits and many discretes. When you flip the switch to turn on the power, if it isn't put together correctly you begin to see smoke and maybe even a fire. We are getting short circuits in our social structure today, and the smoke is billowing up.

The economic situation plays its part in this unclear picture of the future. The financial trends have been inflationary, but will this continue? We see indications today in some industries—automotive, for example—that the public is resisting higher priced products.

The economic effect of the social turbulence mentioned a moment ago is a reasonably predictable thing. It will be inflationary and it will be diverting. The cost of protest and demonstration is high these days. You cannot budget for it and you end up spending funds planned for other uses. The purpose of the protest is to divert funds from one application to another—primarily from defense spending to social needs. Already the results of protest are being felt:

Spend less on the war!
Buy more equality!
Ban the bomb!
Bring in birth control!
Economy in Government!
Ecology for our earth!

These shifts are having their impact on the electronics industry with its close ties to military needs, and please understand, in cataloging these facts, I am not being judgmental.

All of the economic effects are not domestic. International trends contribute. The advent of supersonic intercontinental travel further reduces any need to restrict business ties to a limited geographic area. Already electronic components are being shipped from one continent to another for assembly. These finished products are then sold across much of the world. Engineering and design tasks have been moved across the oceans and so have the engineers and designers. Such actions are but the forerunners of future cooperation. The economic effect will be significant when such actions are routine.

Not only will the ease of international transport have its effect, but the whole international relations picture will, of course, greatly affect the 1980s. In his April 20th speech in New York, Secretary [of Defense] Laird warned that the Soviet Union could take the ICBM lead by the mid-1970s. The Chinese Peoples Republic has put up its first satellite. The United Arab Republic continues to accept more Soviet participation on the ground and in the air, the whole Mediterranean basin continues to be subjected to communist expansionism, and the Southeast Asia story is all-too-well known to all of us. As we look through this glass darkly it is obvious that the state of international relations will be a major determinant of the world of the decade of the 1980s.

What effect does technology have? And particularly electronics technology? Since the birth of electronics about 1900 and the beginning of the Scientific Age, technology has had an increasing role in our lives. If suddenly today all electrical and electronic equipment were to disappear, we would be a lost generation stumbling around in the dark.

With science reigning supreme for these last 50 or so years, we should be looking forward to a bright new technological world in which to live and enjoy life. The question is, "What is a bright new technological world worth?"

Now it is time to try to look through the haze in hopes of determining where we are going. As we look, it would help to settle in our minds that many of the characteristics of the 1980s are set. It used to be that pragmatic process led to sound decisions for the near term future. But that was when the pace was slower. Today, normal pragmatism does not reach far enough into the past, nor does it consider applications far enough into the future. We can, however, begin to bend the trends so that 20 or more years in the future, the results of our pressure will be significant—and maybe at least noticeable in 10 or 15 years.

Having assured you that you are more or less along for the ride at least through the 1970s, let me also propose that *the problems will be sociological rather than technological.* Masses of people caught up in the on-rushing cataract of science and things become lost as individuals. Individual human values are decreasing even in the face of many public and private endeavors to get back to the people. We see whole groups of people searching for identity. We have tremendous technological capability bred of the marriage of mother science and father competition, but we have too long neglected the personal human relationships.

Lest there are those among you that think we can solve this kind of dilemma by a healthy application of Uncle Sam's mighty dollar, let me say

emphatically that increased budgets alone do not solve this problem!

The scope of social interests have expanded in our time. Social concerns are not now confined to classes of people or ethnic groups—nor even to regional or national boundaries. The scope is as round as the world. It is also not limited to people alone. The new buzz word is ecology. The reason so many are concerned about our environment is that we finally realize that stagnation and pollution do indeed affect people and that time is short.

All types of people are excited and want to do something for our ecology. Thousands of students demonstrated by at least walking to school on the recent Earth day. Just a few years ago no school had a course leading to a degree in ecology. Our ecologists at work today have not had the interdisciplinary training now considered essential. They were geologists or hydrologists or botanists.

One of the major requirements which will emerge as we enter the 10 years beyond this present decade will be to resolve the effective use of our available land. The wide open spaces are being filled in with houses, factories, apartments and office buildings, all interconnected with miles upon miles of paved roadways.

Land use challenges are not restricted to the urban and suburban locations although at present they are more critical there. As the metropolitan complexes grow and join and form into a joint megalopolis, rural lands will be overtaken. This includes farm lands and recreation lands, as well as privately owned land which many people feel is necessary to avoid population claustrophobia. It is heartening to note that some government agencies have valiantly been moving to acquire recreation land to preserve and protect it from encroachment. But more effort is needed.

The sociological problems of living by the mid-1980s with 50 percent more people will overshadow the technological surge which has now become our standard of living.

What will all this mean to the electronics community in our target decade? I want to divide the answer to that question into two parts—the challenges and the capabilities.

First, the challenges.

With little effort it is easy to see that the product opportunities will be much greater, and they will continue to grow. Never by the wildest imagination could we conceive of retreating from technological advance. Products unknown to us today and unneeded in this present world will be developed, produced and marketed and become useful and even necessary. These new products will mean more revenue for the industry and more jobs and income for the electronic and electrical engineers.

Another challenge will be the necessity of relating to the demanding social interests. The application of electronic technology to sociological needs will be an enforced diversification which will, in the long run, be healthy for the industry. In the Defense Department we have been preaching diversification to all of industry for a long time, because we could see the trends of tremendous industrial capacity with reduced military spending. For those who haven't already been thinking in this direction the pressure will force your planning to civilian markets.

I foresee opportunities for the electronics community to make major contributions to the world economy. The international market will continue to expand and production on a multi-national basis will include working agreements between independent companies, as well as the use of subsidiaries and franchises.

Probably one of the more significant challenges of the future is really at the door of the electronics industry. That is the opportunity to move into the role of the major systems prime contractor. Too long your industry has been relegated to the subcontractor role. With increasing demand on the use of electronics and with the overwhelmingly important part that electronics equipment is playing in major systems these days, it is time you opened the door and embrace this challenge. As you may know, the Air Force seriously considered reorienting the AWACS [Airborne Warning and Control System] program in December 1968 to use an electronics prime contractor. In that case the consideration grew out of a concern for lack of competition between the two airframe primes. Two reasons contributed to the decision to continue as planned. One reason was that real competition seemed to be available. Later events have proved this to be true. And the second reason was that only one electronics contractor queried offered to participate as a potential prime contractor. This offer was in spite of the fact that competition would be directly against airframe contractors from whom the electronics competitor would have to buy the airframe.

I look forward to the day when the electronics community takes this step —it may not be far off. It is our intention that the Advanced Airborne Command Post system will be competed on the basis of an electronic contractor becoming the prime.

Continuing with challenges of the 1980s, research and development has over the last several years increased in its share of program costs, while at the same time research and development budgets have declined. It seems to me that a certainty for the 1980s will be a continued increase in this direction, particularly for defense oriented work. The mind stretching needs of the time period beyond 1990 and the year 2000, when our world population reaches 6 billion, will challenge even the most capable of the research centers.

You can expect to see more need and involvement of the electronics community in the processes of educating new generations of workers. Revised educational procedures will become a challenge for cooperation between the educator and the electronics engineer. Relationships between the industry and the educational institutions will evolve around the need to provide a faster education and an education which will fit the graduate to multitudinous tasks.

Now for a few moments let me address the industry capabilities of the 1980s as I see them.

First, your industry will be developing equipments with functional requirements for the now unimaginable then. I believe that surely cybernetic applications will increase to the betterment of mankind. And one of the problems which the electronics community will help solve will be the education of people to accept and live in a machine environment.

Next, function speeds and equipment capacities will increase manyfold while equipment size will continue to reduce. We have wondered what there is beyond the miniaturized solid state circuitry. Perhaps some of you already know. I have seen demonstrations of some of the products of innovative thinking in this area and they are exciting.

A final development that I expect to observe in the 1980s will be increased and improved production capability coupled with improved production processing times thus resulting in reduced production costs. The reduction in production costs will have to continue to permit the needed increase in the research and development part of the cost pie. The civilian rather than the military customer will especially benefit from this capability.

Now, let us look at government participation as an influence in the electronics industry future. As I am sure you are aware, the military buyer has been the industry's single most influential customer. This is history—our role is now diminishing and, although I am sure that defense requirements will always be a major contributor to your support, other government participation will grow. In other words, the civilian need sector of Government will become more powerful and motivational in the trends of electronics development and production. One straw-in-the-wind which presages this shift is the prediction by someone that within 10 years the Health, Education and Welfare budget will exceed the Defense budget. Whether this turns out to be true or not, I am sure that HEW, along with Interior and Housing and Urban Development, will be among the major contributors.

This trend, of course, yields a diversified industry.

It is time now that I try to wrap up all these thoughts.

We started out with the Age of Man, the Agricultural Age, the Industrial Age and currently, the Scientific Age. My observation is that we have likely passed beyond the Scientific Age—only time will tell—and we are even now embarked on a new age which I would like to label the Societal Age. There are other possible names, of course, but I think Societal Age best describes the response to the needs and the goals of our turbulent times. We desire to be engaged in community life as a voluntary association of individuals with common aspirations.

"It all boils down to this," Martin Luther King Jr. said, "that all life is interrelated. We are all caught in an inescapable network of mutuality, tied into a single garment of destiny. Whatever affects one directly, affects all indirectly."

The challenges, as we look through this mirror darkly, seem to be exciting. The changing value systems which are sure to emerge constitute a revolution of considerable proportions. How we respond will depend on our willingness to accept our responsibilities for the future.

As for electrical and electronics engineers, in particular, the outlook is broader than it has ever been before. Whole new fields are opening. This will be true technologically as well as geographically. Opportunities for becoming a major element of the developing world-related market place will be yours. As Dwight Eisenhower once said, "Accomplishment will prove to be a journey—not a destination."

Aerospace Material: Old Friends or New?

Excerpt from a speech by Lt. Gen. John W. O'Neill, USAF, Vice Commander, Air Force Systems Command, to the 1970 Air Force Materials Symposium, Miami Beach, Fla., May 18, 1970.

Lieutenant General John W. O'Neill, USAF, is Vice Commander of the Air Force Systems Command. He previously served as commander of AFSC's Space and Missile Systems Organization and Commander, Electronic Systems Division, AFSC. He holds a bachelors degree from Boston University, a masters degree from the University of Pittsburgh, and is a graduate of the Air War College.

In the Air Force, as never before in our history, we are finding it essential to push harder against the material and structural limits of our knowledge. We are forced to look over and beyond the horizon for new materials; new combinations; new structural concepts; and new methods of fabricating, testing, inspecting, and *predicting*.

But the overall problem is greatly compounded by two governing environmental conditions.

The first is the harsh physical environment in which our systems must now perform. We ask our new aircraft to fly higher and faster than ever before—in some cases at the fringes of space—and still be large enough to carry an effective combat payload over extended ranges. Yet we want them to be inconspicuous, if not invisible, to any means of detection. Beyond that, we often need to ask for high speed capability on the deck, adding a whole new set of material and structural demands. And we'd like all the extra power and maneuverability we can get, while consuming a minimum of fuel, to say nothing of good low speed, high lift performance so we can operate from small airfields, and the ruggedness and simple maintainability to go with more primitive strips.

Our missiles have to do incredible things under even worse conditions, with the added proviso that no humans will be aboard to make inflight

corrections. They have to remain in place for years and then, within a minute's notice, perform at 100 percent.

With our spacecraft, finally, we simply combine the harshest requirements imposed on both aircraft and missiles. And the difficulties will be compounded as the Air Force and NASA jointly develop reusable boosters, shuttles and tugs for the space transportation system.

So we're really challenging every extreme of the physical environment: in temperatures, pressures, loads and exceedingly hostile phenomena—both natural and man-made.

Then we also face a second, hostile environment—the socio-economic climate within which we must pursue our military goals. For some time to come, we're going to have to accomplish our management tasks, our missions, our operations, our research and development, and our systems acquisitions with progressively diminishing resources. I think we have all begun to feel the pinch, but I suspect that it's only the beginning.

So the number of avenues we can explore is inevitably going to be curtailed. Thus, because we must be more *selective*, we likewise have to be much wiser in our choices of what to go forward with. It will require all the ingenuity we can muster to bring in the surviving systems on time, doing what they are supposed to, and—above all—remaining in the same dollar ball park they were conceived in.

This surely means that we *ourselves* must have greater confidence in new technology before we stake everything we have—or are likely to get—on it. By confidence in technology, I mean *proven demonstration in the configuration in which it will ultimately see service.*

That's why it's more than a mere coincidence that all the people manning our Air Force system program offices are hard to convince—that's the way we pick them. They have the prime responsibility for the programs they direct. And we have made it very clear to them just how deep that responsibility goes. So you really have to *show* them that any new technology is *ready* for any particular system they're in charge of.

This might seem like a way of keeping new technology out, but that's not really true. We have many types of advanced development programs to make sure that new technology is nurtured and encouraged. But what we need, in addition, is a more intimate, more frequent and more effective dialogue between the program managers and the laboratory people—both from AFSC laboratories and from industry.

We need to have more engineering and development people, those who are running the advanced development programs, spending time with the program managers, *demonstrating* a new method, material, or design concept—*and demonstrating it in terms of improved operational capability.*

I'm afraid we may also be a bit loose in the way we view and define the term "feasibility." Numerous things can be shown to be feasible in the laboratory, which is to say that they perform pretty much as visualized and conform to the laws of physics and chemistry. That, however, is often a long way from what a major program director has in mind when he thinks of feasibility. And the program director's view, tempered by the real world of finite dollars, must finally govern.

So, to the program people—and right on up to the Secretary of Defense—feasibility must include at least the following: rigorous predictability on fatigue and fracture parameters; complete understanding of the material/structural interface; fail-safe or fail-operational design; reliable test and inspection procedures; and quality control and ability assurance techniques for every step in the production process. And all this despite the fact that we probably will not have long production runs to bolster our confidence and broaden our statistical base.

The basic dichotomy was well illustrated at the Paris Air Show of 1965, when the USSR first displayed the AN-22. The designer of this very large transport, Oleg Antonov, was present at the show and answering questions. Western engineers asked him why, on such a new aircraft, he was using turboprop engines designed years before and used on several older Soviet aircraft. "Sometimes," Antonov replied, "it is better to have one old friend than two new ones."

This difficult path, between comfortable old friends who have proved their worth and fascinating new ones who are mostly unknown, is the one we are constantly traveling. Those who seek out and develop new technology have an obligation to fight for these "new friends," and to persuade the rest of us that it will be worth our while to exchange some of our trusted "old friends" for the new ones. In order to do so, they are going to have to do some thorough and exhaustive research on these new friends and make sure that they are very familiar with their backgrounds. In the light of social and budgetary pressures, and the fewer choices they portend, they will need more than unbridled enthusiasm to be convincing.

Which is not to say, by any means, that we will not continue to take the calculated risk; the very nature of the world and of our profession demands that we do. But we *will* insist upon being more certain than ever before that the calculations behind the risk are rigorous and precise.

That rigor and that precision—those are the challenges we face. Every material with which man has ever built, throughout his long and stormy history, was once locked in the ground. It took ideas—and hard work—to get them out, and to convert them into useful materials and artifacts. The pace of this progress has accelerated greatly over the past 20 years, and the curve will climb even more steeply in the years ahead. You are the people who will force the curve upward. With your knowledge, with your hard work, with your ideas, we will progress inevitably into the age of new and far better materials for Air Force aerospace applications.

WSMR Radar Complex Transferred to USAF

An Army White Sands Missile Range sensor complex, consisting of Target Tracking Radar (TTR-3) and Discrimination Radar (DR-1) in Launch Complex 38, has been transferred to the Air Force Range Measurement Laboratory (RML).

RML, an element of Patrick AFB, Fla., plans to update and modify the complex to advanced sensor status.

Total Air Force Research and Development Effort Assumed by AFSC

The Air Force has merged its primary basic research organization, the Office of Aerospace Research (OAR), with its principal applied research, development, test and acquisition agency, the Air Force Systems Command (AFSC). The consolidation became effective on July 1. Thus AFSC is now responsible for the entire research and development spectrum—from an innovative idea in the mind of an Air Force or contract scientist, until a "new generation" piece of hardware or scientific improvement has finished its tests and evaluation and is handed over to the using command.

Joining the Air Force's two research commands to foster a total environment even more conducive to high quality research had been under study for several years. However, it was recognized that great care would have to be taken to ensure that visibility of research was maintained, and that the basic research function would continue to receive the leadership and management attention it had in the past.

Among the objectives of the merger, agreed upon by the Secretary of the Air Force, the Assistant Secretary of the Air Force (Research and Development), and the Commanders of AFSC and OAR, are:

- Improvements resulting in a strong research program of greater value to the Air Force.
- Total environment conducive to high quality research activities (as distinct from development).
- Maintenance of visibility of research at the Office of the Secretary of the Air Force.
- Continued management sensitivity to the nature of universities and the research they conduct.
- Continued operation of the major laboratories of OAR as separate entities at their present locations.
- Preservation of certain OAR policies and procedures which have demonstrated their worth, such as the procurement of research with universities and the Management and Scientific Information System (MASIS), a centralized computer system.
- Application of management advances to the AFSC Directorate of Laboratories and vice versa.
- Continued reasonable freedom of action and freedom from detailed direction for creative researchers.
- Conduct of research with a greater awareness of present and future operational needs of the Air Force.
- Effecting reasonable economies in recognition of the austere budgets facing the Air Force, although the primary purpose of the merger was not cost reduction.
- Minimizing disruptive impacts in placing civilian personnel.

Field installations of the Office of Aerospace Research were kept intact. Personnel of OAR's headquarters at 1400 Wilson Blvd., Arlington, Va., were absorbed into AFSC's headquarters and moved to Andrews AFB, Md. The Office of Scientific Research—a former subordinate element of OAR—will continue to operate at the Arlington address as a self-sufficient unit.

Fifty-nine of the individuals who moved to AFSC headquarters are now assigned to the Command's Director of Laboratories (DOL). DOL will now supervise the four former OAR laboratories in addition to the nine already under its jurisdiction. Another 80 people joined AFSC offices and directorates to do work parallel to that they had done at OAR.

What OAR Brought to AFSC

The Office of Aerospace Research grew out of the pre-existing Air Force Office of Scientific Research (which it retained as a major subordinate element) and was organized as a separate Air Force operating agency with major command status on April 1, 1961.

Its mission was to perform and support relevant research for maintaining present and future Air Force superiority; to conduct a portion of the Air Force's exploratory research in space; and to provide research results to governmental and non-governmental research and development agencies for their use in improving aerospace technology, weapons, equipment, and operations.

Major General Paul T. Cooper

OAR conducted research for the Air Force through its own laboratories; through an extensive contracts and grants program with colleges, universities, individuals and private industry; and through space experiments. Its research endeavors were grouped into the four general areas of physical, engineering, environmental, and life sciences.

OAR mission and research efforts continue uninterrupted at the four laboratories and other support functions which OAR brought to AFSC in the merger. The former OAR laboratories are:

Air Force Office of Scientific Research (OSR). This is the primary Air Force agency for supporting extramural basic research in nuclear and general physics, chemistry, mathematics, electronics, mechanics, energy conversion, astronomy and astrophysics, and the terrestrial, behavioral and information sciences. Quality, rather than quantity, is the objective. The program is directed toward creating new knowledge needed to evolve future technologies for the Air Force, and to assist development efforts in solving technical problems.

OSR selects research for support

from unsolicited proposals which are evaluated by its project scientists on the basis of originality, scientific significance, scientific competence of the investigator, and applicability to Air Force requirements. It carries out its research program through more than 1,200 grants and contracts with approximately 200 colleges, universities, individuals, and research organizations in the United States, Canada, Europe, South America, Australia, Africa, and Asia.

Air Force Cambridge Research Laboratories (CRL). Formerly OAR's largest subordinate unit, the Air Force Cambridge Research Laboratories at L. G. Hanscom Field, Mass., have both a research and exploratory development mission. A complex of 10 separate laboratories, CRL concentrates on research in geophysics. The exploratory development mission falls in the area of the environmental sciences, which include terrestrial and atmospheric sciences, astronomy, and astrophysics.

The 10 CRL laboratories use the most advanced equipment for such endeavors as infrared, radio astronomy, and balloon research. Their fields of research are principally in the areas of data sciences, microwave physics, aerospace instrumentation, meteorology, space physics, terrestrial sciences, optical physics, aeronomy, ionospheric physics, and solid state sciences.

CRL manages so-called "operating locations" at Thule Air Base, Greenland, Catalina, Ariz., Sacramento Peak, N.M., Patrick AFB, Fla., Vandenberg AFB and Chico, Calif., and Holloman AFB, N.M., for work in communications propagation, radar and radio astronomy, balloon research, and other areas. The Sacramento Peak Observatory at Sunspot, N.M., is one of the largest CRL sites and is a leading facility for studying solar activity.

Scientists at CRL each year instrument more than 50 large research rockets for launch from the White Sands Missile Range, N.M., and Wallops Island, Va. In addition, CRL designs special payloads for Air Force and NASA satellites. Several highly instrumented "flying laboratories"—C-135 and C-130 aircraft—are also used by CRL scientists to study atmospheric densities, pressures and temperatures.

Aerospace Research Laboratories (ARL). The second largest subordinate unit was the Aerospace Research Laboratories at Wright-Patterson AFB, Ohio. Its research is largely in the physical and engineering sciences. It maintains 10 separate laboratories doing research in chemistry, metallurgy and ceramics, general physics, fluid dynamics facilities, applied mathematics, plasma physics, thermomechanics, solid state physics, hypersonics, and energetics.

ARL has one of the nation's leading wind tunnel facilities. It is used to test aerodynamic designs, materials, and models. The laboratories are pacesetters in such fields as supersonic combustion, electrofluid dynamic energy conversion, dust particle separation, rare earth studies, and low and high energy density plasmas.

Frank J. Seiler Research Laboratory. Newest and smallest of the former OAR laboratories is the Frank J. Seiler Laboratory, an inhouse laboratory located at the Air Force Academy, near Colorado Springs, Colo. Dedicated in October 1963, its staff conducts research in chemistry, applied mathematics, and aerospace mechanics. Its mission also includes promoting, encouraging, and supporting academy faculty and cadet research, and providing computer support for the academic program. Hopefully, this laboratory will stimulate interested cadets to enter the research field.

Other Activities

Office of Research Analyses (ORA). Envisioning the requirements of the world 10 to 50 years in the future, scientists and technicians of OAR's former Detachment 8, Office of Research Analyses (now redesignated as AFSC's Detachment 37, Office of Research Analyses) evaluate proposed weapon systems and aerospace projects to determine their value in the changing world.

Generally, the mission of ORA is to relate Air Force research activities to operational requirements. Serving as a marketing facility for the Air Force Systems Command, ORA, through systems analyses, keeps other agencies advised of research accomplished. ORA provides cost estimates for future weapons systems development and future operating costs. Examples of ORA studies in the past are defensive and offensive strategies, military space launch systems, ballistic missile defense systems, and the prediction of solar activity in connection with manned space flight.

The Office of Research Analyses is now under the operational control of AFSC's Deputy Chief of Staff for Development Plans.

European Office of Aerospace Research (EOAR). During the last 25 years many technological contributions from foreign scientists have been of direct value to the U.S. Air Force. During this time a good percentage of the new ideas leading to basic theoretical progress, particularly in the atomic sciences, was sparked by foreign scientists, primarily European, or by scientists trained abroad. For most of this period the Air Force has been engaged in cooperative research with European nations and other countries of the free world. Work with foreign scientists has developed a mutual working base aimed at technological advancement.

In order to facilitate the flow of scientific information from the foreign scientific community to the Air Force scientists, and to foster and strengthen their intercommunication, EOAR maintains an office in London, England, to manage the Air Force's foreign research activities in Free Europe, the Near East, the Middle East (including India, Burma and Ceylon) and Africa. Air Force foreign research activities in Canada, Australia, New Zealand and South America are administered directly by Air Force agencies in the United States. In the Far East, procurement of foreign research for the Air Force is handled by the Army's research office in that area.

The European Office of Aerospace Research screens foreign research and exploratory development proposals and then forwards them to appropriate laboratories in the United States for evaluation.

Management and Scientific Information System. Several thousand scientists at several hundred government, academic, industrial and private laboratories do basic research for

(Continued inside back cover)

Status of ASPR Committee Cases

The following is a listing (revised as of June 1, 1970) of the cases currently under consideration by the Armed Services Procurement Regulation (ASPR) Committee, of the Office of the Assistant Secretary of Defense (Installations and Logistics).

On items marked by asterisks, the text has been omitted to shorten the listing. The asterisks denote actions taken as shown below:

*—Case closed, no ASPR revisions resulting.

**—Case closed, approved for printing in a subsequent ASPR revision.

***—Case closed, approved for printing subject to further government coordination.

The listing includes subjects of interest to contractors but excludes cases of a minor or editorial nature, those considered "sensitive," and those involving a deviation from the regulation which are processed by the ASPR Committee.

The ASPR Committee meets with representatives of major industry associations periodically to explain the purpose and status of each of the cases under consideration, and to answer questions from industry representatives concerning the cases. All proposed ASPR changes of major policy are forwarded to industry associations in draft form for the review and comments of the association memberships. Industry comments are evaluated by the Defense Department before a final decision on the proposal is made by the ASPR Committee.

Communications Services. Development of uniform ASPR coverage which would permit deletion of existing departmental coverage with respect to procurement of communication services from both regulated and unregulated suppliers. Industry comments have been received, considered, and revised coverage developed. Comments from the Office of the Director, Telecommunications Management, and the Federal Communications Commission have been received and are under consideration.

Advance Understandings of Allowability, ASPR 15-107. To revise the existing ASPR paragraph to explicitly provide that such agreements must be in writing to be binding on the Government. Proposed ASPR coverage concerning Advance Understandings on Particular Cost Items was forwarded to industry for comment on May 29, 1968. Final action on this case has been deferred pending completion of the committee's consideration of case on the corporate administrative contracting officer.

Revisions to ASPR 15-205, Cost Principles on Bid and Proposal and Independent Research and Development. The proposed revisions to the existing ASPR cost principles on Independent Research and Development and Bid and Proposals were developed as a staff action outside of the ASPR Committee and referred to the committee for editing and the obtaining of industry comments. This material was forwarded to industry on Jan. 29, 1968. On March 25, 1968, the reporting date for submission of comments by industry and government agencies was extended to June 30, 1968. Industry comments have been received. The subject case is still under study.

Clauses for Service Contracts. To develop a new part for ASPR Section VII to cover service contracts generally, incorporating by reference, to the extent feasible, the fixed-price and cost-reimbursement clauses contained in Parts 1 and 2 of Section VII. This matter is still under development.

Proposed ASPR 9-203(f) Clause, Rights in Technical Data—For RDT&E and Acquisition Contracts for Major Systems and Subsystems. To consider modifying the ASPR policy concerning rights in technical data insofar as research, development, test and evaluation (RDT&E and acquisition contracts for majo systems and subsystems are con cerned, by prescribing a special claus for inclusion in prime major system and prime subsystems RDT&E con tracts which would require the con tractor to permit subcontractors t sell subcontractor fabricated parts o services directly to the Governmen without the payment of license fees o other inhibition not withstanding tha such subcontractor effort may requir the use of limited rights data fur nished by the prime contractor. Con sideration of the coverage in this are was delayed awaiting receipt of com ments from CODSIA. Proposed cover age was forwarded to industry fo comment on March 31, 1970.

***Mandatory Application of ASPR Cost Principles in Fixed-Price Con tracts.*

Delinquent Delivery Schedules on Other Than Cost-Reimbursement Type Supply and Service Contracts. To modify various provisions of Section VII, Part 6, to clarify the rights and obligations of both parties in the event of delinquent performance. The proposed revisions were forwarded to industry for comment on March 3, 1969. Industry comments have been received. This matter is still under consideration.

**Transfer of Materials Between Contracts.*

Termination—Deferring Determi nation Whether for Default or Con venience Clause. To consider whether an ASPR clause embodying the subject concept should be developed for inclusion in the regulation. Such a clause, half-way between the present ASPR Default clause and the present ASPR Termination for Convenience of the Government clause would permit termination of a contract while deferring the contracting officer's decision as to whether (a) the contract is in default; or (b) termination should be for convenience of the Government. To also consider whether the Stop Work Order clause should be modified to authorize conversion of a stop work order to a termination for default as well as a termination for convenience as is now provided. This item was forwarded to industry for comment on July 18, 1969. The date for receipt of comments was extended

to Oct. 6. Industry and government comments are still under consideration.

Conflict of Interest Clause. To consider whether further guidance in the regulation and appropriate contractual safeguards should be provided to avoid conflicts of interest which may be occasioned by acquisitions and mergers involving systems engineering contracts. This item was forwarded to industry for comment on July 8, 1969. Comments have been received and are currently under study.

ASPR Section IX, Part 2. To consider whether amendments to Section IX, Part 2, and other pertinent ASPR sections are necessary in view of the re-issued DOD Instruction 5010.12, dated Dec. 5, 1968, entitled "Management of Technical Data." The changes developed under this case will be forwarded to industry for comment in the near future.

***Construction Warranty Clause, ASPR 1-324.10.*

***Location Allowances at Unfavorable Locations.*

Verification of Catalog or Market Price Exceptions Under Public Law 87-653. To consider the recommendation of the GAO that ASPR be revised (a) to require contractors to submit sales data of recent commercial sales for approximately similar quantities, of the proposed purchase by the Government, prior to acceptance by the Government of a catalog or market price, and (b) to further provide that contracting officers be required to verify the sales data submitted by contractors. The proposed coverage and a new Form 633 were forwarded to industry for comment on Sept. 29, 1969. Industry and government agency comments have been received, and are under consideration.

Health and Safety Clauses. To review and present recommended changes concerning the applicability of the Health and Safety clauses currently prescribed in 7-104.78, .79, and .80, in light of the comments on this matter received from CODSIA. Revised ASPR coverage was forwarded to industry on Sept. 2, 1969. Comments have been received and are under consideration.

Revision of ASPR B-311, C-311, and S3-603. To make necessary revisions to Appendix B-311 and Appendix C-311 and Supplement 3 to provide for uniform reporting by contractors of government property. Revisions to DD Form 1662 are included in the case and the proposed coverage is under consideration.

**Financial Accounting for Government-Owned Facilities.*

Single-Service Management of Industrial Facilities. To develop procedures which will provide that only one contract authorizing use of government facilities will be in effect at any one location. It is intended that contracts which authorize the acquisition or furnishing of government facilities will provide for the automatic transfer of those facilities to the "use" contract upon receipt of installation. The subcommittee reporting date has been extended to June 1, 1970.

Corporate Administrative Contracting Officer Program. To provide for the appointment of a single corporate administrative contracting officer to act, in the case of multiplant companies, on matters which have corporate-wide application. The corporate administrative contracting officer will not act on matters having only local application. These matters will continue to be received by the plant administrative contracting officer. This matter is now under consideration by higher authority.

Bailment of Government Property to Contractors. To consider the development of proposed ASPR coverage including definition and policy with respect to bailment of government property to a contractor as well as to the development and publication of a standard ASPR format of bailment agreement for DOD-wide use. This matter is currently being studied.

ASPR 15-205.6(f), Deferred Compensation. To clarify ASPR 15-205.6(f) covering deferred compensation in light of the questions raised concerning: (a) whether deductibility for Federal income tax purposes is a prerequisite to allowability for contract cost purposes; (b) the extent to which actuarial gains and losses (including unrealized market appreciation and depreciation) must be taken into account in determining costs; (c) whether the cost of improvements in benefits to retired employees is allowable; (d) whether pay-as-you-go pension payments are allowable; and (e) whether contributions of interest equivalents or unfunded pension liabilities are allowable. This item was forwarded to industry for comment on July 8, 1969. Industry and government agency comments have been received and considered. This matter is now being considered by higher authority as a matter involving major policy.

***Limitation of Costs, ASPR 7-203.3, Limitation of Funds, ASPR 7.402.2.*

ASPR Coverage for Training and Educational Costs. To consider the necessity for revising 15-205.44 in light of internal and external correspondence indicating (a) the need for supplemental guidance to cover cost of attendance of contractor employees at specialized courses, such as those conducted by the Harvard Graduate School of Business Administration; (b) to allow part-time education related to "company area of interest in the field where the employee is now working or may reasonably be expected to be employed;" (c) liberalization of the 156 hours per year limitation on part-time education; (d) relaxation of the one-year limitation for full-time graduate or post-graduate study and allowing education for other than engineering and scientific purposes; (e) allowing "matching payments;" and (f) to consider the feasibility of allowing all reasonable training and educational costs. Proposed coverage was forwarded to industry and other government agencies for comment on Jan. 6, 1970. Comments have been received and are currently under study.

Forward Pricing Rate Agreements. To consider the desirability of providing ASPR coverage with respect to forward pricing rate agreements covering (a) definition, (b) establishment, (c) use, and (d) procedures, as well as the relationship of such agreements to contracts subject to the requirements of Public Law 87-653. Proposed coverage has been developed and was forwarded to industry for comment on Oct. 30, 1969. Comments have been received and are under consideration.

Clarification of Application of CWAS to Limitations Contained in the Cost Principles. To consider the

need of clarifying the application of Contractor's Weighted Average Share (CWAS) to specified restrictions or exclusions contained in the cost principles, as well as the correction of any errors in the CWAS designations. The proposed revisions were forwarded to industry for comment on Nov. 18, 1969. Comments have been received and are under consideration.

Warranties—Consequential Damages. To develop Department of Defense policy and appropriate ASPR coverage for contractual warranties expressed and implied relating to latent and patent defects, as well as consequential damages. This assignment involves not only consideration of the expressed or implied warranties under the Inspection clause, but further includes consideration of whether specific contractual provisions should be developed to cover these areas. This matter is still under consideration.

Severance Pay to Employees on Support Service Contracts. To consider whether ASPR 15-107 "Advance Understandings on Particular Cost Items" should be expanded to explicitly cover severance pay when support service contracts are replaced, particularly with respect to payment to employees whose employment with the phasing-out contractor is severed but who maintain continuity of employment and credit for seniority with the follow-on contractor. Additional clarifying language has been developed by the committee and concurred in for the purpose of obtaining industry comments. Industry comments have been received and are under consideration.

***Negotiated Overhead Rates Clause.*

Late Proposals and Modifications in Negotiated Procurements. To consider revising 3-506 covering late proposals and modifications thereof in negotiated procurements in light of the numerous General Accounting Office decisions in this area. This matter is still under study.

Omnibus GAO and DOD Audit Clauses. To consider the feasibility of developing an omnibus General Accounting Office Examination of Records clause and an omnibus DOD Audit clause to replace the existing Examination of Records clauses and numerous DOD Audit Clauses. The development of a single Examination of Records clause has been undertaken in conjunction with representatives of the General Accounting Office. Similarly, a draft of a proposed single DOD Audit clause has been developed. The new clauses were forwarded to industry for comment on Jan. 20, 1970. Industry and government agency comments have been received and are under consideration.

Evaluation Criteria. To undertake the development of additional guidance of evaluation criteria to be included in solicitations, thus giving effect to numerous General Accounting Office decisions that prospective offerors should be advised of the relative importance to be attached to each evaluation factor. This matter is still under study.

Revision of Billing Prices Under Incentive Contracts and Price Redetermination Contracts. To review the ASPR 7-108 Incentive Price Revision and the 7-109 Price Redetermination clauses and to recommend changes therein to permit upward adjustment of billing prices to conform to the policy in ASPR 3-404(a)(4). The military services have been authorized to deviate from the restrictions of the clauses pending the issuance of revised clauses which are currently being developed.

Pricing of Indefinite Delivery Type Contracts. To consider revising ASPR 3-409 to modify the restriction that indefinite delivery type contracts must provide for (a) firm fixed prices, (b) price escalation, or (c) price redetermination, by allowing pricing on the basis of common manufacturers' price lists or industry pricing guides. This matter is presently under study.

Contractor Procurement System Review (CPSR). To consider expanding existing ASPR coverage on CPSRs and consent to subcontract provisions to provide more detailed guidance. A report on this subject will be considered in the near future.

Time Extensions. To consider the inclusion of a Time Extensions clause in construction contracts in which liquidated damages are included. A clause clarifying the existing rights of the Government under the clauses set forth in ASPR 7-602.5 "Termination for Default—Damages for Delay—Time Extensions" and ASPR 7-602.3 "Changes" (Feb. 1968 version), to extend the time for completion of work when a contractor is delayed by any of certain enumerated excusable delays, was forwarded to industry for comment on March 23, 1970.

Proposed Revision of ASPR Appendix I. To consider if Appendix I requires changes to make it compatible with Military Standard Contract Administration Procedures (MILSCAP)/departmental/contract administration office and consignee requirements. A report on this subject will be considered in the near future.

Wage and Price Escalation. To review existing ASPR escalation provisions to determine the advisability of developing additional wage and material price escalation clauses for use in contracts for complex weapon systems to be produced over an extended period of time. Clauses developed by a special study group established to review this subject were forwarded to industry for comment May 18, 1970.

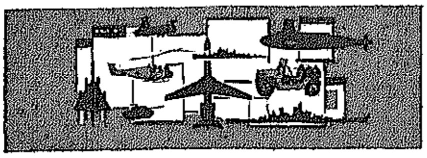
Proposed Change to ASPR 15-205.16, Insurance and Indemnification. To consider a suggestion that ASPR 15-205.16 be revised to specifically limit allowable costs of self-insurance for future liabilities to an amount determined on a present value basis. A report on this matter will be considered in the near future.

Allocation of Contractors' Cost for Special Facilities. To consider additions or revisions to Section XV to clarify cost allocation procedures under 15-201.4 in general, and allocation of the costs of special facilities such as wind tunnels, in particular. This matter currently is under study.

Capital Data Employed. To consider the advisability of initiating a policy change to use capital-employed as a factor in developing prenegotiation profit objectives. This matter has been assigned to a specially selected subcommittee and currently is under study.

Military Sealift Command

The Military Sea Transportation Service has been renamed Military Sealift Command. Vice Admiral Arthur B. Gralla is Commanding Officer. Offices are at 3800 Newark NW, Washington, D.C.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of June 1970.

DEFENSE SUPPLY AGENCY

2—The following contracts were awarded by the Defense Fuel Supply Center, Alexandria, Va., for JP-5 jet fuel:

Carson Oil Co., Los Angeles, Calif. $3,576,100. 30,240,000 gallons. DSA 600-70-D-1591.

Coastal States Petrochemical Co., Houston, Tex. $5,942,920. 55,083,200 gallons. DSA 600-70-D-1592.

Fletcher Oil and Refining Co., Carson, Calif. $1,588,260. 13,500,000 gallons. DSA 600-70-D-1594.

Gulf Oil Co., Houston, Tex. $4,031,160. 42,000,000 gallons. DSA 600-70-D-1597.

Humble Oil and Refining Co., Houston, Tex. $10,090,763. 100,790,000 gallons. DSA 600-70-D-1599.

Phillips Petroleum Co., Bartlesville, Okla. $2,072,592. 17,760,000 gallons. DSA 600-70-D-1604.

Powerine Oil Co., Santa Fe Springs, Calif. $2,891,001. 25,000,000 gallons. DSA 600-70-D-1605.

Sun Oil Co., Philadelphia, Pa. $1,103,000. 10,000,000 gallons. DSA 600-70-D-1607.

Tenneco Oil Co., Houston, Tex. $1,918,000. 20,000,000 gallons. DSA 600-70-D-1608.

Union Oil Co. of Calif., Los Angeles, Calif. $1,802,170. 15,456,000 gallons. DSA 600-70-D-1610.

U.S. Oil and Refining Co., Tacoma, Wash. $1,128,452. 9,438,000 gallons. DSA 600-70-D-1611.

—The following contracts were awarded by the Defense Fuel Supply Center for JP-4 jet fuel:

Famariss Oil and Refining Co., Hobbs, N.M. $1,225,832. 10,800,000 gallons. DSA 600-70-D-1611.

Fletcher Oil and Refining Co., Carson, Calif. $2,416,758. 22,500,000 gallons. DSA 600-70-D-1643.

Fort Worth Refining Co., Fort Worth, Tex. $2,996,534. 28,450,000 gallons. DSA 600-70-D-644.

Getty Oil Co., New York, N.Y. $3,898,777. 38,640,000 gallons. DSA 600-70-D-1645.

Gulf Oil Co., Houston, Tex. $1,290,420. 11,970,000 gallons. DSA 600-70-D-1648.

Hercules Oil Co. of San Diego, Inc., Long Beach, Calif. $1,420,312. 11,950,000 gallons. DSA 600-70-D-1649.

Amerada Hess Corp., Woodbridge, N.J. $1,238,334. 12,364,800 gallons. DSA 600-70-D-1650.

Howell Refining Co., San Antonio, Tex. $2,396,569. 23,000,000 gallons. DSA 600-70-D-1652.

Humble Oil and Refining Co., Houston, Tex. $17,068,259. 174,515,000 gallons. DSA 600-70-D-1653.

Husky Oil Co. of Delaware, Denver, Colo. $1,095,283. 10,420,000 gallons. DSA 600-70-D-1655.

Kern County Refinery, Inc., Los Angeles, Calif. $3,848,555. 33,614,324 gallons. DSA 600-70-D-1657.

MacMillan Ring-Free Oil Co., Inc., Los Angeles, Calif. $3,349,191. 30,000,000 gallons. DSA 600-70-D-1663.

Continental Oil Co., Houston, Tex. $2,800,651. 26,000,000 gallons. DSA 600-70-D-1634.

Crystal Flash Petroleum Corp., Indianapolis, Ind. $1,100,170. 9,830,000 gallons. DSA 600-70-D-1635.

Delta Refining Co., Memphis, Tenn. $4,167,936. 40,470,000 gallons. DSA 600-70-D-1636.

Edgington Oil Co., Long Beach, Calif. $2,132,904. 19,580,000 gallons. DSA 600-70-D-1639.

Mobil Oil Corp., New York, N.Y. $12,245,535. 124,028,024 gallons. DSA 600-70-D-1660.

Monarch Refining Co., Div. of Wing Corp., San Antonio, Tex. $1,408,749. 13,000,000 gallons. DSA 600-70-D-1667.

Navajo Refining Co., Artesia, N.M. $3,297,343. 31,000,000 gallons. DSA 600-70-D-1668.

Okmulgee Refining Co., Inc., Olkmulgee, Okla. $6,913,194. 72,020,000 gallons. DSA 600-70-D-1670.

Phillips Petroleum Co., Bartlesville, Okla. $7,529,251. 71,870,000 gallons. DSA 600-70-D-1674.

Adobe Refining Co., La Blanca, Tex. $1,350,807. 12,320,000 gallons. DSA 600-70-D-1612.

American Oil Co., Chicago, Ill. $4,067,486. 38,040,000 gallons. DSA 600-70-D-1615.

Americana Petrofina Co. of Texas, Dallas, Tex. $2,203,552. 20,800,000 gallons. DSA 600-70-D-1616.

Ashland Oil Inc., Ashland, Ky. $4,891,149. 47,722,000 gallons. DSA 600-70-D-1618.

Atlantic Richfield Co., Chicago, Ill. $2,101,681. 23,064,000 gallons. DSA 600-70-D-1620.

Atlantic Richfield Co., Los Angeles, Calif. $2,907,451. 27,300,000 gallons. DSA 600-70-D-1621.

Atlantic Richfield Co., Philadelphia, Pa. $1,234,145. 11,810,000 gallons. DSA 600-70-D-1622.

Bayou Refining Co., Inc., Pasadena, Tex. $1,217,853. 11,900,000 gallons. DSA 600-70-D-1623.

Carson Oil Co., Los Angeles, Calif. $4,267,121. 38,640,000 gallons. DSA 600-70-D-1627.

Chevron Oil Co., Denver, Colo. $7,940,954. 77,188,000 gallons. DSA 600-70-1620,

Cities Service Oil Co., New York, N.Y. $1,518,938. 16,800,000 gallons. DSA 600-70-D-1630.

Coastal States Petrochemical Co., Houston, Tex. $3,786,824. 38,135,200 gallons. DSA 600-70-1632.

Powerine Oil Co., Santa Fe Springs, Calif. $1,667,671. 15,680,000 gallons. DSA 600-70-D-1675.

Pride Refining, Inc., Abilene, Tex. $1,824,332. 16,500,000 gallons. DSA 600-70-D-1676.

Signal Oil and Gas Co., Houston, Tex. $1,405,530. 15,456,000 gallons. DSA 600-70-D-1678.

Southland Oil Co., Div. of Vermont Gas Systems Inc., Yazoo City, Miss. $1,101,482. 12,000,000 gallons. DSA 600-70-D-1679.

Southwestern Pallet Co., Abilene, Tex. $3,328,219. 34,000,000 gallons. DSA 600-70D-1681.

Standard Oil Co. of Calif., San Francisco, Calif. $17,550,466. 166,152,000 gallons. DSA 600-70-D-1682.

Sun Oil Co., Philadelphia, Pa. $9,564,414. 94,140,000 gallons. DSA 600-70-D-1683.

Tesora Petroleum Corp., San Antonio, Tex. $5,140,090. 44,190,000 gallons. DSA 600-70-D-1684.

Tesoro-Alaskan Corp., San Antonio, Tex. $7,299,540. 68,680,000 gallons. DSA 600-70-D-1685.

Texaco Inc., Long Island City, N.Y. $3,710,474. 39,441,888 gallons. DSA 600-70-1686.

Tonkawa Refining Co., Houston, Tex. $2,421,592. 23,180,000 gallons. DSA 600-70-D-1687.

Toscopetro Corp., Bakersfield, Calif. $1,383,886. 12,500,000 gallons. DSA 600-70-D-1688.

Triangle Refineries, Inc., Houston, Tex. $1,798,345. 17,000,000 gallons. DSA 600-70-D-1689.

—**Harnischfeger Corp.**, Milwaukee, Wis. $9,467,273. 20-ton cranes, shovel fronts and associated maintenance/repair data. Escanaba, Mich., and Scarborough, Ontario, Canada. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-9505.

3—**Page Airways, Inc.**, Rochester, N.Y. $1,096,221 (contract modification). Operation and maintenance of the Defense Industrial Plant Facility, Atchison, Kan., for FY 1971. Defense Industrial Plant Equipment Center, Memphis, Tenn. DSA 200-68-C-0002-P00050.

—**Rebmar, Inc.**, Corozal, Puerto Rico, $1,065,091. Rucksacks. Morovis, Puerto Rico. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1923.

—**Trenton Textile Engineering and Manufacturing Co., Inc.**, Trenton, N.J. $2,751,548. 398,198 wet-weather ponchos for the Army. Dover, Del., and Trenton. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1943.

4—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for fuel oil and gasoline:

Olympia Oil and Wood Products Co., Olympia, Wash. $2,518,207. DSA 600-70-D-1810.

Western Operations, Inc., Standard Oil Co. of Calif., San Francisco, Calif. $1,546,453. DSA-600-70-D-1840.

5—**The Sportwelt Shoe Co.**, Nashua, N.H. $1,300,730. 416,000 pairs of tropical combat boots. Grafton, Sullivan and Hillsboro counties, N.H. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1954.

8—**Sinclair Caribbean Oil Co., of Atlantic Richfield Co.**, New York, N.Y. $2,190,913. 23,000,000 gallons of JP-4 jet fuel. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1721.

—**Bata Shoe Co., Inc.**, Belcamp, Md. $3,508,869. 103,130 pairs of insulated boots. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1897.

9—**Drexel Dynamics Corp.**, Horsham, Pa. $1,826,312. 234 electric fork lift trucks. Defense General Supply Center, Richmond, Va. DSA 400-70-C-4610.

—**Western Operations, Inc., Standard Oil Co. of Calif.**, San Francisco, Calif. $1,491,160. 7,333,700 gallons of petroleum products for use in Alaska. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1864.

10—**Island Creek Coal Sales Co.**, Cleveland, Ohio, $2,467,025. 245,500 net tons of bituminous coal for General Services Administration. Coal Mountain and Amherstdale, W. Va. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-0195.

—**Southern Packaging and Storage Co., Inc.**, Greeneville, Tenn. $1,305,482. 1,742,967 cases of individual combat meals. Mullins,

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

S.C. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-70-C-S604.

11—Hyster Co., Portland, Ore. $1,087,685. 96 fork lift trucks, 15,000 pound capacity. Danville, Ill. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-9860.

—Usibelli Coal Mine, Inc., Usibelli, Alaska. $2,435,895. 350,000 net tons of bituminous coal. Suntrana, Alaska. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D 1500.

16—Trenton Textile Engineering and Manufacturing Co., Inc., Trenton, N.J. $1,358,298 (contract modification). Army ponchos. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-1943.

18—The Defense Personnel Support Center, Philadelphia, Pa., issued the following contracts for men's oxford dress shoes:
Genesco, Inc., Nashville, Tenn. $1,373,521. 208,000 pairs. Tullahoma, Tenn., and Huntsville, Ala. DSA 100-70-C-2015.
Endicott Johnson Corp., Endicott, N.Y. $1,583,591. 239,342 pairs. DSA 100-70-C-2014.

—Sauk Valley Manufacturing Co., Oakland, Calif. $1,480,696 (contract modification). 117,645 spools of barbed wire. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-A080.

19—Little Giant Crane and Shovel, Inc., Des Moines, Iowa. $3,960,982. 92 truck-mounted cranes, 20-ton capacity. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-8940.

23—Island Creek Coal Sales Co., Cleveland, Ohio. $1,481,700. 132,000 net tons of bituminous coal. Stowe, W. Va. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1511.

25—Tan-Tex Industries Corp., New York, N.Y. $1,262,190. 1,661,000 linear yards of navy shade 3359 twill cloth. Lexington, N.C., and Westerly, R.I. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-2057.

—The Defense Construction Supply Center, Columbus, Ohio, issued the following contracts:
Hyster Co., Portland, Ore. $1,460,687. 297 fork-lift trucks. Danville, Ill. DSA 700-70-C-9619.
Caterpillar Tractor Co., Peoria, Ill. $14,-768,984. 414 full-track medium tractors. DSA 700-70-C-9522.
Earthmoving Equipment Div., General Motors Corp., Hudson, Ohio. $2,765,184. 64 Terex model 82-30/M full-tracked tractors. DSA 700-70-C-9604.

26—Rapistan, Inc., Rockville, Md. $1,025,957. Mechanized materials handling system for the Navy. Grand Rapids, Mich. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-9600.

—Sauk Valley Manufacturing Co., Oakland, Calif. $1,599,114 (contract modification). 126,646 spools of barbed wire. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-A080.

—Franklin Clothes, Inc., Woodbine, N.J. $1,-230,498. 73,375 men's polyester wool serge coats for the Air Force. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-70-C-2062.

29—The following contracts for cotton sateen cloth were awarded by the Defense Personnel Support Center, Philadelphia, Pa.:
Saddler Textile, Inc., New York, N. Y. $1,131,145. 1,000,000 linear yards (45-in. wide) and 1,110,714 linear yards (42-in. wide). Batesburg, S.C.; Eastman, Ga.; and Opelika, Ala. DSA 100-70-C-2036.
Graniteville Co., New York, N. Y. $1,-621,800. 2,400,000 linear yards (42-in. wide). Augusta, Ga.; and Graniteville, S.C. DSA 100-700-C-2038.
Prestex, Inc., New York, N.Y. $2,924,617. 5,000,000 linear yards (45-in. wide). Batesburg, S.C.; Eastman and Commerce, Ga.; and Opelika, Ala. DSA 100-70-C-2027.
Riegel Textile Corp., New York, N.Y. $5,-230,300. 3,000,000 linear yards (45-in. wide). Ware Shoals, S.C.; and Trion, Ga. DSA 100-70-C-2029.

—Outboard Marine Corp., Milwaukee, Wis. $1,189,000. 660 centrifugal pumps. Galesburg, Ill. Defense Construction Supply Center, Columbus, Ohio. DSA 700-70-C-9617.

DEPARTMENT OF THE ARMY

1—Missouri Pacific Railroad Co., and Missouri Illinois Railroad Co., St. Louis, Mo. $9,000,000. Relocation of a railroad crossing over the Kaskaskia River, Randolph County, Ill. Army Engineer District, St. Louis, Mo. D-CW43-70-C-0087.

—Stanford University, Stanford, Calif. $1,-948,529 (contract modification). Research in mathematical theory computation and related areas of computer science. Defense Supply Service, Washington, D.C. DA-SD-63-133.

—Bernard McMenamy Contractor, Inc., St. Charles, Mo. $5,342,600. Excavation of approximately 5 miles of navigation channel, Monroe and St. Clair counties, Ill. Army Engineer District, St. Louis, Mo. DA-CW43—70-C-0188.

—Hughes Aircraft Co., Culver City, Calif. $7,777,866. FY 1970 TOW missile ground support equipment. El Segundo and Culver City, Calif. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0318.

—Guy F. Atkinson Co., San Francisco, Calif. $61,724,437. Construction of an earth fill dam at the Cochiti Dam and Reservoir Project, Sandoval County, N.M. Army Engineer District, Albuquerque, N.M. DA-CW47-70-C-0006.

—Con-Plex Div., US Industries, Inc., New Orleans, La. $1,149,732. Construction of a hurricane protection levee and flood wall, Lake Pontchartrian Hurricane Protection Project, New Orleans, La. Army Engineer District, New Orleans, La. DA-CW29-70-C-0226.

2—The Teletype Corp., Skokie, Ill. $3,000,000. Classified electronic equipment. Army Electronics Command, Fort Monmouth, N.J.

—The Holiday Construction Co., Greenville, Ga. $1,150,742. Road construction, Troup County, Ga. Army Engineer District, Savannah, Ga. DA-CW21-70-C-0048.

3—Southern Airways of Texas, Inc., Fort Wolters, Tex. $36,288,000 (contract modification). Training of helicopter pilots, aircraft maintenance and related services. Purchasing and Contracting Office, Fort Wolters, Tex. DA-BD13-69-C-0012.

—Electro Magnetic Technology Corp., Montgomeryville, Pa. $1,117,771. Vulcan weapon system test equipment. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0559.

—Acme Construction Co., Inc., Cleveland, Ohio. $3,177,222. Construction of a dam and appurtenant works, North Branch of the Kokosing Reservoir, Ohio. Army Engineer District, Huntington, W. Va. DA-CW69-70-C-0067.

—D. R. Allen and Sons, Inc., Fayetteville, N.C. $1,060,706. Channel improvement, Lick Run, Bedford County, Va. Army Engineer District, Wilmington, N.C. DA-CW54-70-C-0035.

—Sheldow Bronze Corp., Kingwood, W. Va. $1,683,120. 75,000 bronze grave markers. The Office of the Chief of Support Services, Memorial Division, Washington, D.C. DA-49-056-SS(70)-396.

4—Industrial Contractors, Inc., Idaho Falls, Idaho. $3,074,224. Construction of a test area building and a control building, Arnold Engineering Development Center, Tullahoma, Tenn. Army Engineer District, Mobile, Ala. DA-CA01-70-C-0049.

5—The International Terminal Operating Co., Inc., New York, N.Y. $20,758,758. Stevedoring and related terminal services at the Military Area MTMTS, Brooklyn, N.Y. Eastern Area Military Traffic Management and Terminal Service, Brooklyn, N.Y. DA-HC21-70-D-0174.

—International Harvester Co., Southfield, Mich. $3,749,608. 1,081 4x2 stake trucks. Springfield, Ohio. DA-AE07-C-4377. $1,-602,078. 207 4x2 truck tractors. Ontario, Canada. DA-AE07-70-C-4366. Army Tank Automotive Command, Warren, Mich.

—Embry-Riddle Aeronautical Institu[t] tona Beach, Fla. $4,038,341. Fix rotary wing instrument flight t Fort Rucker, Ala. Army Aviation and School, Fort Rucker, Ala. DA 71-C-0003.

8—M. M. Sundt Construction Co., Ariz. $1,844,056. Excavation of fiv of channel with compacted fill lo stone facing, Ruby Wash Diversion Winslow, Ariz. Army Engineer I Los Angeles, Calif. DA-CW09-70-

—Bush Construction Co., Norfolk, V 394,000. Design and construction family housing units, Fort Mead Army Engineer District, Baltimore.

—Cramer Brothers Construction C Moines, Iowa. $1,979,972. Stage II co tion of an earth levee and concret wall. Army Engineer District, Rock Ill. DA-CW25-70-C-0073.

—Dravo Corp., Pittsburgh, Pa. $41, Construction of a dam and appur works, and removal of existing loc dams, Newburgh Locks and Dams Warwick County, Ind., and He County, Ky. Army Engineer District, ville, Ky. DA-CW27-70-C-0110.

—Conductron Corp., St. Charles, Mo. 000 (contract modification). Classifi tronics equipment. Army Electronic mand, Fort Monmouth, N.J.

—Poland Contracting Corp., Poland, $2,732,621. Treatment of existing pl lets and sanitary sewer crossings, and related work, Local Protection Youngstown, Ohio. Army Engineer D Pittsburgh, Pa. DA-CW59-70-C-017

—Rosick Construction Co., Inc., Mo Ark. $2,488,270. Construction of crete gated spillway, bridge and building, Carter's Dam, Murray Coun Army Engineer District, Mobile, Al CW01-70-C-0253.

9—Zenith Radio Corp., Chicago, Ill. 000 (contract modification). M429 fu 2.75 inch rockets. Army Ammunitio curement and Supply Agency, Joli DA-AA09-70-C-0108.

10—Philco-Ford Corp., Palo Alto, Calif. 793. One heavy and one medium tra able satellite communications ter Army Electronics Command, Fort mouth, N.J. DA-AB07-70-C-0234.

—Beech Aircraft Corp., Wichita, Ka 802,000. U-21A utility aircraft. Army tion Systems Command, St. Louis, M AJ01-70-C-0760.

—Jahncke Service, Inc., New Orleans $1,207,700. Construction of first-lift of the Chalmette Extension Hurrica tection Levee, St. Bernard Paris Army Engineer District, New Orlea DA-CW29-70-C-0248.

—Great Lakes Dredge and Dock Co York, N.Y. $1,013,044. Dredging c in the vicinity of Staten Island, N. Bayonne, N.J. Army Engineer D New York, N.Y. DA-CW51-70-C-0

—List and Clark Construction Co., O Park, Kan. $6,005,728. Highway and construction, Harry S. Truman Da Reservoir, Benton County, Mo. Army neer District, Kansas City, Mo. DA-70-C-0098.

—J. R. Youngdale Construction Co. and T. Walter Johnson (Joint ve San Diego, Calif. $2,111,204. Thre story buildings, Fort Knox, Ky. Arm gineer District, Louisville, Ky. DA-70-C-0034.

—AVCO Corp., Stratford, Conn. $1,3 Modification kits for T-53 gas turb gines. Army Aviation Systems Com St. Louis, Mo. DA-AJ01-70-A-0334.

11—The Army Electronics Command, For mouth, N.J., issued the following con
Servo Corp. of America, Hicksvill $2,146,080. Development, fabricati test of two automatic atmospheric ing sets (AN/TMQ-19) for use Meteorological Data Sounding (AN/NMQ-7). DA-AB07-70-C-02
SCM Corp., Deerfield, Ill. $5,990, engineering development and serv models of the Forward Area T Teletypewriter and ancillary items AB07-70-C-0177.

—The following contracts were iss the Army Electronics Command, Ph phia, Pa.:
Hamilton Watch Co., Lancaster, P

085,796 (contract modification). AN/PRC-77 radio sets and RT-841/PRC-77 receiver-transmitters. DA-AB05-70-C-4412.

Bristol Electronics, Inc., New Bedford, Mass. $2,114,016. AN/PRC-25 radio sets. DA-AB05-70-C-4416.

ternational Harvester Co., Southfield, Mich. $1,800,953. 330 stake, van and trailer trucks. Springfield, Ohio. Army Automotive Command, Warren, Mich. DA-AE07-70-C-4365.

VCO Corp., Stratford, Conn. $1,631,265. Turbine nozzles for the T-53 gas turbine engine. Army Aviation Systems Command, St. Louis, Mo. DA-F-41-608-69-A-2421.

The Army Engineer District, Kansas City, Mo., issued the following contracts:

List and Clark Construction Co., Overland Park, Kan. $4,388,103. Construction of an embankment levee, Missouri River, Platte County, Kan. DA-CW47-70-C-0101.

Anderson Construction Co., Inc., Holton, Kan. $2,675,000. Relocation of section II, Missouri state highway 7, and construction of a 2,000 plate girder bridge and approximately two miles of road, Denton County, Mo. DA-CW41-70-C-0102.

Vestinghouse Electric Corp., Portland, Ore. 1,207,391. Single and three phase power transformers. Muncie, Ind., and Clearwater County, Idaho (installation). Army Engineer District, Walla Walla, Wash. DA-CW68-70-C-0110.

B and C Co., Scottsdale, Ariz. $1,154,128. Construction of 3,500 feet of concrete channel, Corte Madera Creek, Marin County, Calif. Army Engineer District, San Francisco, Calif. DA-CW07-70-C-0097.

American Standard, Inc., Falls Church, Va. 4,500,000. Classified electronic equipment. Falls Church and Mountain View, Calif. Army Electronics Command, Fort Monmouth, N.J.

nterlake, Inc., Riverdale, Ill. $1,240,000. One automated stocker and retrieval system for depot maintenance rebuild activities at the Anniston Army Depot. Anniston Army Depot, Anniston, Ala. DA-AG02-70-C-0077(J).

Gulf and Western Industries, Waukesha, Wis. $1,130,655. Metal parts for body assemblies for the M384. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0281.

The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications:

Hercules, Inc., Wilmington, Del. $8,465,-158. Operation of the propellant production facility, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-00037(A).

Olin Corp., Stamford, Conn. $3,974,918. Operation of the propellant production facility, Army Ammunition Plant, Charleston, Ind. DA-AA09-69—C-0148.

The Aluminum Co. of America, Pittsburgh, Pa. $1,338,000. 2.75-inch rocket motor tubes. Kensington, Pa. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0256.

I. A. Anderson Co., Inc., Portland, Ore. 0,120,000. Construction of a fish hatchery, Lost Creek Reservoir, Jackson County, Ore. Army Engineer District, Portland, Ore. DA-CW57-70-C-0132.

Jordan and Nobles Construction Co., El Paso, Tex. $1,210,000. Construction of two concrete buildings, relocation of an existing metal building, erect and furnish a metal pre-fab building, and construction of sidewalks, paving and utilities, White Sands Missile Range, N.M. Army Engineer District, Fort Worth, Tex. DA-CA63-70-C-070.

The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts:

Universal Automatic Machine, Inc., Marshall, Tex. $1,032,229. Lifting plugs for 155mm, 175mm and 8-inch projectiles. DA-AA09-70-C-0389.

The National Metals Manufacturing Co., Centerville, Iowa. $12,444,071. Metal parts for 155mm M107, projectiles. Sylacouga, Ala. DA-AA09-70-C-0418.

The Tiombo Corp., San Carlos, Calif. $4,-28,059. Road and bridge construction and repair work, Dry Creek Reservoir and Channel, Sonoma County, Calif. Army Engineer District, San Francisco, Calif. DA-CW07-70-C-0099.

—L and A Contracting Co., Inc., Hattiesburg, Miss. $1,077,237. Construction of a four-bay control structure with automatic controlled lift gates, removal of two canal plugs, and random shoals, Four River Basins Project, Pinellas County, Fla. Army Engineer District, Jacksonville, Fla. DA-CW17-70-C-0088.

—Amron-Orlando Div., Gulf and Western Industries, Inc., Orlando, Fla. $1,104,788. M551 fuze metal parts. Army Procurement Agency, Chicago, Ill. DA-AA09-70-C-0103.

—Pettibone Corp., Bethesda, Md. $3,378,450. 90 rough terrain fork-lift trucks. Chicago, Ill. Army Mobility Equipment Command, St. Louis, Ill. DA-AK01-70-C-7149.

17—The Army Electronics Command, Philadelphia, Pa., issued the following contracts:

Gichner Mobile Systems, Inc., Dallastown, Pa. $1,107,859. Electrical equipment shelters. DA-AB05-69-C-0019.

Futuronics Corp., Port Washington, N.Y. $2,612,346. 2,328 teletypewriter sets. DA-AB05-70-C-4121. $2,017,080. 1,504 teletypewriter transmitter reperforators. Freeport, N.Y. DA-AB05-70-C-4123.

—The Director of Procurement, Western Area Military Traffic Management and Terminal Service, Oakland, Calif., issued the following contracts:

California Stevedore and Ballast Co., San Francisco, Calif. $24,996,212. Stevedoring and related services, Army base facilities, Oakland. DA-HC23-70-D-0085.

Marine Terminals Corp. of Los Angeles, Long Beach, Calif. $10,500,000. Stevedoring and related services, Southern California Outport, Long Beach. DA-HC23-70-D-0081.

—Gordon H. Ball, Inc., and Granite Construction Co. (joint venture), Danville, Calif. $26,196,440. Construction of a 23-foot diameter steel and concrete lined tunnel approximately 3,400 feet long, and outlet works, New Malones Reservoir, Stanislaus River, Stanislaus and Tuolumme Counties, Calif. Army Engineer district, Sacramento, Calif. DA-CW05-70-C-0106.

—Dickerson, Inc., Monroe, N.C. $4,778,512. Construction of 2.7 miles of two lane highway, and two concrete bridges, New Hope Reservoir, Chatham County, N.C. Army Engineer District, Wilmington, N.C. DA-CW54-70-C-0034.

—Lueder Construction Co., Omaha, Neb. $1,581,293. Construction of control tower additions and a utility building, Offutt AFB, Neb. Army Engineer District, Omaha, Neb. DA-CA45-70-C-0099.

—Western Electric Co., New York, N.Y. $1,-600,000 (contract modification). Additional research and development on the modified Spartan subsystem of the Safeguard Ballistic Missile Defense System. McDonnell-Douglas Corp., Santa Monica, Calif., Army Safeguard System Command, Huntsville, Ala. DA-30-069-AMC-00333(Y).

—L. E. Mayson, Hyde Park, Mass. $1,312,000. Air munitions nose assemblies. Edgewood Arsenal, Md. DA-AA15-70-C-0474.

—Batesville Manufacturing Co., Batesville Ark. $2,257,700. M72A1 rocket launchers. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0421.

—The Electronic Memories and Magnetic Corp., Hawthorne, Calif. $1,250,000. Classified electronic equipment. Army Electronics Command, Fort Monmouth, N.J.

—The Appalachian Contracting Co., Robinsville, N.C. $1,054,100. Clearing and disposal of trees and stumps, Connelton Lock and Dam Project, Hancock, Breckinridge, Bullitt and Meade Counties, Ky., and Perry, Crawford and Harrison Counties, Ind. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0124.

18—Washington University, St. Louis, Mo. $1,200,000 (contract modification). Development of a macro-modular computer system. Defense Supply Services, Washington, D.C. DA-SD-65-00302.

—Telletsen Construction Co., Houston, Tex. $3,604,808. Hurricane flood protection pump station structures, Jefferson County, Tex. Army Engineer District, Galveston, Tex. DA-CW64-70-C-0082.

—Farrell Construction Co., Inc., Memphis, Tenn. $11,156,706. Dam, levee, service building and diversion channel construction, Wallisville Dam and Reservoir, Chambers County, Tex. Army Engineer District, Galveston, Tex. DA-CW64-70-C-0083.

—Forsberg and Gregory, Inc., Redlands, Calif. $1,924,854. Construction of 100 family housing units, Fort Huachuca, Ariz. Army Engineer District, Los Angeles, Calif. DA-CA09-70-C-0090.

19—Industrial Design Labs, Inc., Culver City, Calif. $1,572,460. M8 portable automatic chemical agent alarms, M229 refill kits, and various quantities of testers, provisioning parts and manuscripts. Edgewood Arsenal, Md. DA-AA15-70-C-0447.

—Servidone Construction Corp., Castleton, N.Y. $4,711,352. Construction of levees, flood walls and drainage system, pumping station and closure gate, Raritan and Sandy Hook Bays Project, Monmouth County, N.J. Army Engineer District, New York, N.Y. DA-CW51-70-C-0040.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts for metal parts for M117 AIEI 750-pound bombs:

R. G. LeTourneau, Inc., Longview, Tex. $6,238,400. DA-AA09-70-C-0411.

American Machine and Foundry Co., New York, N.Y. $1,327,656 (contract modification). DA-AA09-70C-0279.

—Amis Construction Co., Oklahoma City, Okla. $7,915,430. Construction of an embankment, outlet works, spillway, access roads and project buildings, Dierks Dam Project, Howard and Sevier Counties, Ark. Army Engineer District, Tulsa, Okla. DA-CW56-70-C-0159.

—J. B. Denny Jr., Norfolk, Va. $1,350,706 Five story bachelor officers quarters, Fort Lee, Va. Army Engineer District, Norfolk, Va. DA-CA65-70-C-0104.

—Mountain State Construction Co., Inc., Charleston, W. Va. $8,999,696. Construction of a tunnel, spill basin, control tower and access bridge, Gathright Reservoir Project, Va. Army Engineer District, Norfolk, Va., DA-CW65-70-C-0075.

—Western Electric Co., New York, N.Y. $2,-000,000 (contract modification). Additional research and development on the Spartan subsystem of the Safeguard ballistic missile defense system. McDonnell-Douglas Corp., Santa Monica, Calif. Safeguard System Command, Huntsville, Ala. DA-30-C69-AMC-333.

22—Beckman Construction Co., Fort Worth, Tex. $1,176,740. Development of an area for public use, Stockton Reservoir Project, Cedar and Wade Counties, Mo. Army Engineer District, Kansas City, Mo. DA-CW41-70-C-0110.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications for metal parts for M106 high explosive 8-inch projectiles:

National Presto Industries, Eau Claire, Wis. $3,411,478. DA-AA09-69-C-0109.

United States Steel Corp., Pittsburgh, Pa. $1,893,711. Berwick, Pa. DA-AA09-70-C-0238.

—Frank Tasch, Silver City, N.M. $1,016,200. Construction of a development facility consisting of a masonry building and a prefab metal building, and paving and utilities, White Sands Missile Range, N.M. Army Engineer District, Fort Worth, Tex. DA-CA63-70-C-0073.

—Department of Public Works and Buildings, Springfield, Ill. $3,730,000. Design and relocation construction work, Illinois state highway 3, Kaskaskia River, Randolph County, Ill. Army Engineer District, St. Louis, Mo. DA-CW43-70-C-0138.

—Texas Instruments Inc., Dallas, Tex. $2,-500,000. Classified electronic equipment. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0560.

—Chrysler Corp., Sterling Township, Mich. $5,225,000 (contract modification). Systems engineering management for the M60/M60A1 tank, M48A3, M60A1 chassis, and M728 combat engineer vehicle. Army Weapons Command, Rock Island, Ill. DA-AF03-70-C-0075.

23—Crown Construction Co., Columbus, Ga $5,-076,000. Construction of 340 family housing units, Fort Benning, Ga. Army Engineer District, Savannah, Ga. DA-CA21-70-C-0056.

—Burns, Kirkley and Williams, Inc., Auburn,

Ala. $1,232,807. Construction of aviation training facilities, Fort Rucker, Ala. Army Engineer District, Mobile, Ala. DA-CA01-70-C-0050.

—General Construction Co., Fargo, N.D. $6,-989,763. Construction of a levee and flood wall, Port Arthur Hurricane Flood Protection Project, Jefferson County, Tex. Army Engineer District, Galveston, Tex. DA-CW64-70-C-0088.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications:

Day and Zimmerman, Inc., Philadelphia, Pa. $5,214,832. Operation of facilities, Army Ammunition Plant, Parsons, Kans. DA-AA09-70-C-0245.

Maxson Electronic Corp. of Riker-Maxson, Macon, Ga. $2,276,649. Loading and assembling 60mm illuminating projectiles, M83A3. DA-AA09-70-C-0165.

Medico Industries, Inc., Wilkes-Barre, Pa. $2,799,000. Metal parts, XM229, for 2.75 inch rockets. DA-AA09-70-C-0365.

—Industrial Engineering Co., Inc., Baltimore, Md. $2,589,000. Construction of an addition to Kimbrough Army Hospital, and renovation of existing structure, Fort Meade, Md. Army Engineer District, Baltimore, Md. DA-CA31-70-C-0066.

—AVCO Corp., Wilmington, Mass. $1,993-181. Classified research and development. Defense Atomic Support Agency, Washington, D.C. DA-SA01-70-C-0158.

—TRW, Inc., Redondo Beach, Calif. $5,000,-000. Classified research and development. Army Electronics Command, Fort Monmouth, N.J.

—Saginaw Products Corp., Saginaw, Mich. $1,137,436. 731 two-wheel trailer chassis, M353. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-4640.

—B. Bornstein and Son, Inc., Philadelphia, Pa. $3,593,150. Construction of confinement facilities, Fort Dix, N.J. Army Engineer District, New York, N.Y. DA-CA51-70-C-0084.

—Beatrice Foods, Honolulu, Hawaii. $1,046,-009. Furnishing of dairy products for FY 1971. Office of the Assistant Chief of Staff for Logistics, U.S. Army, Hawaii. DA-GA01-70-D-0577.

24—Anthony J. Bertucci Construction Co., New Orleans, La. $1,595,250. Construction of bank paving at various locations along the Mississippi, Atchafalaya and Red Rivers. Army Engineer District, New Orleans, La. CA-CW29-70-C-0266.

—Umpqua River Navigation Co. Div., Bohemia Lumber Co., Eugene, Ore. $9,185,-000. Rehabilitation of the Humboldt Bay jetty, Eureka, Calif. Army Engineer District, San Francisco, Calif. DA-CW07-70-C-0103.

—National Presto Industries, Eau Claire, Wis. $6,639,725. Metal parts for 105mm projectiles, M1. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0028.

—Daniel and House Construction Co., Monterey, Calif. $1,668,318. Construction of a three story 400-man dormitory, Language School, Presidio, Monterey, Calif. Army Engineer District, Sacramento, Calif. DA-CA05-70-C-0070.

—Goodyear Tire and Rubber Co., Akron, Ohio. $1,576,277 (contract modification). Track shoe assemblies for M113 personnel carriers. St. Mary's, Ohio. Army Tank Automotive Command, Warren, Mich. DA-AE07-70-C-4152.

—Page Airways, Inc., Rochester, N.Y. $1,-279,565. Automated storage and retrieval system for depot maintenance activities, Tobyhanna Army Depot, Pa. Tobyhanna Army Depot, Tobyhanna, Pa. DA-AG38-70-C-0191.

—Lane Construction Corp., Meriden, Conn. $7,356,517. Construction of an embankment, channel spillway and outlet work, Woodcock Dam, Crawford County, Pa. Army Engineer District, Pittsburgh, Pa. DA-CW59-70-C-0179.

—A. J. Kanipe and Sons, and Jim R. Smith Contracting Co., Inc. (joint venture), Smithland, Ky. $1,194,430. 13 miles of channel excavation stone protection work, Saline River, Gallintin County, Ill. Army Engineer District, Louisville, Ky. DA-CW27-70-C-0129.

25—Dorsett Electronics, Tulsa, Okla. $1,300,-000. Classified electronics equipment. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0577.

—Holloway Construction Co., Holloway Sand and Gravel, Inc., and Halloway Sand and Gravel Trucking Corp. (joint venture), Wixsom, Mich. $14,899,671. Stage III embankment, Chatfield Dam and Reservoir, South Platte River, Colo. Army Engineer District, Omaha, Nebr. DA-CW45-70-C-0095.

—Federal Systems Div., IBM Corp., Gaithersburg, Md. $3,568,782 (contract modification). Combat Services Support Systems (CS3) for one year. Fort Hood, Tex., and Germany. Procurement Office, Army Electronic Command, Washington, D.C. DA-AB09-67-C-0408.

—Great Lakes Dredge and Dock Co., New Orleans, La. $2,277,085. Dredging a 40-foot deep channel in waterways adjacent to Port Arthur, Tex. Army Engineer District, Galveston, Tex. DA-CW64-70-C-0090.

—Frequency Engineering Labs of Harvard Industries, Farmingdale, N.J. $4,345,430. XM28E1 armament sub-systems for the AH-1G Cobra helicopter. Army Weapons Command, Rock Island, Ill. DA-AF03-70-C-0083.

—Aerojet General, Inc., Nimbus, Calif. $3,-610,000. Rocket motors for Hawk missiles. Army San Francisco Procurement Agency, Oakland, Calif. DA-AG05-70-C-0733.

—Acushnet Co., New Bedford, Mass. $1,122,-416. M25A1 protective tank masks and ABC-M24 protective aircraft masks. Edgewood Arsenal, Md. DA-AA15-70-C-0411.

—Texas Instruments, Inc., Dallas, Tex. $1,-241,610 (contract modification). Preliminary ballistic missile defense equipment development for data processing system. Safeguard System Command, Huntsville, Ala. DA-HC60-70-C-0061.

—The Army Mobility Equipment Command, St. Louis, Mo., issued the following contracts:

Southwest Truck Body Co., Inc., St. Louis, Mo. $1,418,488. 104 retrofit kits for shop equipment, electronic and electrical repair. DA-AK01-70-C-7689.

Caterpillar Tractor Co., Peoria, Ill. $2,-580,262. 48 wheeled tractors. DA-AK01-70-C-7088.

Athey Products Corp., Raleigh, N.C. $6,372,050. 220 fork-lift trucks. Wake Forest, N.C. DA-AK01-70-C-7958.

Fourdec, Inc., Pasadena, Calif. $1,021,477. Portable mine-detecting sets. DA-AK01-70-C-7973.

V.P. Co., Pasadena, Calif. $1,023,143. Portable mine-detecting sets. DA-AK01-70-C-7694.

26—Hamet Co., Inc., Paducah, Ky. $2,268,-498. Construction of three spillways with lift gates, and excavation of three canals, Central and Southern Florida Project, Dade County, Fla. Army Engineer District, Jacksonville, Fla. DA-CW17-70-C-0082.

—Harvey Aluminum Co., Inc., Torrance, Calif. $1,172,500 (contract modification). 40mm cartridge cases, M118. Army San Francisco Procurement Agency, Oakland, Calif. DA-AA09-70-C-0264.

—Hughes Aircraft Co., Culver City, Calif. $1,033,109. Maintenance test equipment, technical manuals and new equipment training for depot maintenance equipment for the TOW missile system. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0922.

—Luedtke Engineering Co., Frankfort, Mich. $1,326,537. Maintenance placement of stone protection on the north breakwater of the Ludington Harbor Project, Mich. Army Engineer District, Detroit, Mich. DA-CW35-70-C-0052.

—King-Hunter, Greensboro, N.C. $2,256,568. Construction of a one-story and a six-story building, Fort Bragg, N.C. Army Engineer District, Savannah, Ga. DA-CA21-70-C-0061.

—Burns, Kirkley and Williams, Auburn, Ala. $1,232,043. Construction of an 80-unit addition to an existing Bachelor Officers' Quarters, and construction of a three-story 60-unit motel-type BOQ, Fort Rucker, Ala. Army Engineer District, Mobile, Ala. DA-CA01-70-C-0052.

—The Army Electronics Command, Fort Monmouth, N.J., issued the following contracts:

University of Illinois, Urbana, Ill. $1,-035,000 (contract modification). An additional 12 months research in electronics and plasma technology. DA-AB07-67-C-0199.

D.E.I. Industries, Inc., Rockville, Md. $1,529,092. VHF/FM airborne radio sets, AN/ARC-131. DA-AB07-70-C-0277.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications:

Remington Arms Co., Inc., Bridgeport, Conn. $28,834,441 (contract modification). Operation of 20mm cartridge production facilities, Lake City Army Ammunition Plant, Independence, Mo. DA-49-010-AMC-3(A).

Federal Cartridge Corp., Minneapolis, Minn. $6,905,345. Loading, assembling and packing 5.6mm and 7.62mm cartridges, and related support services, Twin Cities Army Ammunition Plant, New Brighton, Minn. DA-36-038-AMC-1099(A).

—Amron Div. of Gulf and Western Industries, Waukesha, Wis. $5,567,400. 20mm brass cartridge cases, M103. Frankford Arsenal, Philadelphia, Pa. DA-AA25-70-C-0495.

—Hawthorne Aviation, Charleston, S.C. $2,-423,275 (contract modification). Aircraft maintenance and related test support services. Cairns Army Air Field, Fort Rucker, Ala. Aberdeen Proving Ground, Md. DA-AD05-69-C-0417.

—Hunt Building Mart, Inc., El Paso, Tex. $3,309,034. Construction of 150 family housing units, Fort Carson, Colo. Army Engineer District, Kansas City, Mo. DA-CA41-70-C-0063.

—Martin-Zachry Constructors, Honolulu, Hawaii. $1,500,000 (contract modification). Construction of a civilian dormitory, Roi Namur Island, Marshall Islands. Army Engineer District, Honolulu, Hawaii. DA-CA83-70-C-0014.

29—Litton Systems, Inc., Sunnyvale, Calif. $3,-522,434 (contract modification). 1,656 man-months of scientific and technical support for experimentation for the Combat Development Command Experimental Center. Fort Ord and Hunter-Ligget Military Reservation, King City, Calif. Army San Francisco Procurement Agency, Oakland, Calif. DA-AG05-67-C-3096.

—Brencal Contractors, Inc., Detroit, Mich. $2,535,500. Construction of a vehicle track and suspension laboratory, Detroit Arsenal. Army Engineer District, Chicago, Ill. DA-CA23-70-C-0078.

—Philco-Ford Corp., Willow Grove, Pa. $2,-685,000. Integration of defense special security communications systems in the AUTODIN network. Willow Grove and 12 overseas sites. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-70-C-0322.

—Jervis B. Webb, Detroit, Mich. $2,411,370. Manufacture and installation of an integrated materials handling system. Army Procurement Agency, New York, N.Y. DA-AG25-70-C-0617.

—Urban System Development Corp., Arlington, Va. $2,250,000. Construction of 100 family housing units, Vint Hill Farms Station, Warrenton, Va. Army Engineer District, Norfolk, Va. DA-CA65-70-C-0111.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications:

General Motors Corp., Detroit, Mich. $3,-524,776. Lay-away and rehabilitation work on facilities, Army Ammunition Plant, St. Louis, Mo. DA-AA09-67-C-0025.

Donovan Construction Co., New Brighton, Minn. $3,501,100. Metal parts for 155mm projectiles, M107. Twin Cities Army Ammunition Plant. DA-AA09-70-C-0085.

National Presto Industries, Inc., Eau Claire, Wis. $9,335,567. Metal parts for 105mm projectiles. DA-AA09-69-C-0028.

Mason and Hanger, Silas Mason Co., Inc., New York, N.Y. $1,360,530. Operation of ammunition assembling facilities, Cornhusker Army Ammunition Plant, Grand Island, Neb. DA-AA09-68-C-0383.

Mason and Hanger, Silas Mason Co., Inc., Lexington, Gy $3,108,890. Loading, assembling and packing XM131 components

for 155mm projectiles, Army Ammunition Plant, Burlington, Iowa. DA-AA09-68-C-0468.

—The Army Missile Command, Huntsville, Ala., issued the following contracts:
RCA, Burlington, Mass. $4,648,666. FY 1970 research, development, test and evaluation program for land combat support systems. DA-AH01-70-C-1342.
Teledyne-Ryan Aeronautical Co., San Diego, Calif. $2,810,218. Flight services for the MQM-34D Firebee target missile system operations at ranges in New Mexico, Okinawa and Korea. DA-AH01-70-C-0010.
Systems Development Corp., Santa Monica, Calif. $1,348,562. Systems training program for Air Defense Control Systems. DA-AH01-70-C-0006.

—The following contracts were awarded by the Army Engineer District, New Orleans, La.:
Standard Dredging Corp., New Orleans, La. $1,953,900. Construction of the first lift of a hurricane protection levee, including 2,000,000 cubic yards of hydraulic fill, Lake Pontchartrain Project, St. Bernard Parish, La. DA-CW29-70-C-0275.
Atlas Construction Co., Inc., Vidalia, La. $4,459,605. Construction of first lift of a hurricane protection levee on the west bank, Mississippi River between Empire and Buras, Plaquemines Parish, La. DA-CW29-70-C-0273.

—The Army Weapons Command, Rock Island, Ill., issued the following contracts:
Philco-Ford Corp., Newport Beach, Calif. $1,697,000. 100 XM182 pintle mounts. Newport Beach and Anaheim, Calif. DA-AF03-70-C-0084.
Chrysler Corp., Sterling Township, Mich. $6,000,000 (contract modification). System engineering management for M60-A1E2 tanks. Centerline, Mich. DA-AF03-69-C-0087.

—Rubber Fabricators, Inc., Grantsville, W. Va. $1,151,186. Collapsible water tanks, 1,500 and 3,000 gallon capacity. Richwood, W.Va. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-7975.

—The Army Aviation Systems Command, St. Louis, Mo., awarded the following contracts:
Bell Helicopter Co., Fort Worth, Tex. $11,290,912. UH-1N helicopters. Hurst, Tex. DA-AJ01-70-C-0234.
Lockheed Missiles and Space Co., Sunnyvale, Calif. $2,503,054. Support items for YO-3A aircraft. DA-AJ01-70-A-0326.

—D. M. Weatherly Co., Atlanta, Ga. Three contracts for design and construction of ammonia oxidation nitric acid units (used in making TNT), and associated air pollution control: $2,840,000, Army Ammunition Plant, Joliet, Ill., DA-CA01-70-C-0055; $2,334,400, Volunteer Army Ammunition Plant, Chattanooga, Tenn., DA-CA01-70-C-0054; $2,795,000, Army Ammunition Plant, Radford, Va., DA-CA01-70-C-0056. Army Engineer District, Mobile, Ala.

—Monsanto Enviro-Chem Systems, Inc., Chicago, Ill. Design and construction of oleum-sulphuric acid recovery units, and associated pollution control, at these locations: $6,101,100, Army Ammunition Plant, Radford, Va., DA-CA01-70-C-0061; $5,270,000, Volunteer Army Ammunition Plant, Chattanooga, Tenn., DA-CA01-70-C-0059; $7,-364,740, Army Ammunition Plant, Joliet, Ill., DA-CA01-70-C-0060. Army Engineer District, Mobile, Ala.

—Simplex Wire and Cable Co., Portsmouth, N.H. $1,617,860. 55 nautical miles of ocean telephone coaxial cable. Safeguard Systems Command, Huntsville, Ala. DA-HC60-70-C-0083.

—Pacific Car and Foundry Co., Renton, Wash. $1,715,860. Engineering services and provisioning in support of M107, M110 and M578 tracked vehicles. Army San Francisco Procurement Agency, Oakland, Calif. DA-AG05-70-C-0894.

—The Army Engineer District, Mobile, Ala., issued the following contracts:
Burns, Kirkley and Williams Co., Inc., Auburn, Ala. $1,123,461. Construction of an instrument trainer building with support utilities, Fort Rucker, Ala. DA-CA01-70-C-0064.
Chemical Construction Co., New York, N.Y. $2,260,000. Design and construction of a nitric acid concentrator and related air pollution control facilities, Army Ammunition Plant, Radford, Va. DA-CA01-70-C-0062.
Hoechst-Uhde Corp., Englewood, N.J. $7,-766,000. Design and construction of a nitric acid producing unit and associated air pollution control facilities, Army Ammunition Plant, Joliet, Ill. DA-CA01-70-C-0058. $7,863,500. Nitric acid processing unit and air pollution control facilities, Volunteer Army Ammunition Plant, Chattanooga, Tenn. DA-CA01-70-C-0057.

—Trammell Construction Co., Inc., Bristol, Tenn. $1,996,800. Expansion of the water treatment and distribution system, Fort Benning, Ga. Army Engineer District, Savannah, Ga. DA-CA21-70-C-0060.

—Arundel Corp. and L. E. Dixon Co. (joint venture), Baltimore, Md. $22,547,980. Construction of a dam and appurtenances, Hannibal Lock and Dam Project, Ohio River, Wetzel County, W.Va., and Monroe, Ohio. Army Engineer District, Pittsburgh, Pa. DA-CW59-70-C-0118.

—Navigate, Inc., Clearwater, Fla. $1,152,000. Furnishing and installing an automatic storage and retrieval system for depot maintenance activities, Clearwater and Red River Army Depot, Texarkana, Tex. Red River Army Depot, Texarkana, Tex. DA-AG47-70-C-0110.

—Allan Construction Co., Inc., and Bertling Construction Co. (joint venture), San Antonio, Tex. $1,254,427. Construction of a 30,000-foot long levee on the east bank of the Brazos River-Freeport Hurricane Flood Protection Project, Brazoria County, Tex. Army Engineer District, Galveston, Tex. DA-CW64-70-C-0091.

—Hamilton Construction Co., Trenton, N.J. $1,425,395. Construction of an electronic warfare lab, Fort Monmouth, N.J. Army Engineer District, New York, N.Y. DA-CA51-70-C-0094.

—Browning Construction Co., San Antonio, Tex. $7,924,370. Construction of a three-story medical field service school, Brooke Army Medical Center, San Antonio. Army Engineer District, Fort Worth, Tex. DA-CA63-70-C-0081.

—Dollar Excavating Co., Inc., St. Louis, Mo. $2,075,018. Phase II interior road construction, Stockton Reservoir—Sac River Project, Mo. Army Engineer District, Kansas City, Mo. DA-CW41-70-C-0111.

—New Mexico State University, Las Cruces, N.M. $2,115,537. Data reduction for analysis processing and computer operations. Las Cruces and White Sands Missile Range, N.M. Army Test and Evaluation Command, White Sands Missile Range, N.M. DA-AD07-70-C-0234.

—Capital Dredge and Dock Corp., Lorain, Ohio. $2,168,880. Channel dredging and construction of breakwaters, Point Lookout Harbor, Arenac County, Mich. Army Engineer District, Detroit, Mich. DA-CW35-70-C-0058.

—The Army Engineer District, Chicago, Ill., issued the following contracts:
Cenco Piping Corp., General Energy Systems Corp., Jonesville, Wis. $20,928,000. Construction of TNT manufacturing facilities, including industrial buildings and equipment, product transfer piping, roads and railroad utility services, at the Army Ammunition Plant, Joliet, Ill. DA-CA23-70-C-0084.
Chemical Construction Co., New York, N.Y. $4,525,000. Erection and/or installation of a Government-furnished sulfuric acid regeneration plant, Army Ammunition Plant, Newport, Ind. DA-CA23-70-C-0083.

—The Army Engineer District, Jacksonville, Fla., issued the following contracts:
Atlantic Gulf and Pacific Co., Bauer Dredging and Construction Co., Inc., and Western Contracting Corp. (joint venture), Bloomfield, N.J. $7,786,000. Channel dredging, Jacksonville Harbor Project, Fla. DA-CW17-70-C-0103.
Troup Brothers, Inc., Miami, Fla. $4,195,-725. Construction of levees 62 and 63N, structures 192 and 193, and appurtenant work, Central and Southern Florida Project, Highland and Okeechobee Counties. DA-CW17-70-C-0101.

—The Army Tank Automotive Command, Warren, Mich., issued the following contracts:
Kaiser Jeep Corp., Toledo, Ohio. $8,394,-113 (contract modification). 5-ton trucks, XM809 series. South Bend, Ind. DA-AE06-69-C-0009.
Kaiser Jeep Corp., Wayne, Mich. $8,365,-267 (contract modification). 2½-ton trucks, M44 series. DA-AE06-70-C-0001.
Engineered Devices Inc., Agawam, Mass. $1,193,100. 100 class 530C fire trucks. DA-AE01-70-C-7988.
Caterpillar Tractor Co., Peoria, Ill. $3,-910,165. Phase II advanced production engineer program for a series of very high output engines. Mossville, Ill. DA-AE07-70-C-4854.
Teledyne Industries, Inc., Muskegon, Mich. $1,380,000. Engineering support services for multi-fuel engines, LDS-427 and 465. DA-AE07-70-C-4859.
Rakco Creative Services, Inc., Royal Oak, Mich. $1,119,000. Off-site engineering services for technical data publication documentation covering production and out of production vehicles and related equipment. DA-AE07-69-D-0012.
White Engines, Inc., Canton, Ohio. $1,-626,506. 2,298 engines in support of M151 ¼-ton utility trucks. DA-AE07-70-C-4862.

—The Defense Supply Service, Washington, D.C., issued the following contracts:
University of California, Berkeley, Calif. $1,734,486. Research program on the design of a reliable and secure computer system. DA-HC15-70-C-0274.
Rand Corp., Santa Monica, Calif. $4,-299,525 (contract modification). Military science and technology research program. DA-HC15-67-C-0141. $1,980,000 (contract modification). Remote/rural security research program. DA-HC15-67-C-0142.

—Fermont Division, Dynamics Corp. of America, Bridgeport, Conn. $10,578,567. Design, test and fabrication of 60kw generator sets. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-70-C-0596.

—The Safeguard System Command, Huntsville, Ala., issued the following contract modifications:
Control Data Corp., Minneapolis, Minn. $1,228,370. Preliminary ballistic missile defense equipment development for a data processing system. DA-HC60-70-C-0056.
Western Electric Co., New York, N.Y. $2,737,370. Documentation for the Safeguard Ballistic Missile Defense System. Martin-Marietta Corp., Orlando, Fla., McDonnell-Douglas Corp., Santa Monica, Calif., and other locations. DA-30-069-AMC-333. $5,786,000. Additional research and development on the Sprint and Spartan subsystems, and the perimeter acquisition radar for the Safeguard system. General Electric Co., Syracuse, N.Y., Martin Marietta Corp., Orlando, Fla., McDonnell-Douglas Corp., Santa Monica, Calif., and other subcontractors. DA-30-069-AMC-333.

—The Army Mobility Equipment Command, St. Louis, Mo., issued the following contracts:
American Marc Div., Eon Corp., Englewood, Calif. $1,507,752. 5kw generator sets, 60 hp. DA-AK01-69-C-8350.
Fab-Weld Corp., Simpson, Pa. $8,206,475. 7,000 military van cargo containers. Susquehanna and Simpson, Pa. DA-AK01-70-C-7696.

—The Frankford Arsenal, Philadelphia, Pa., issued the following contracts:
Olin Corp., New Haven, Conn. $2,413,740. 5.56mm ball cartridges, M193. DA-AA25-70-C-0344.
Electromagnetic Technology Corp., Montgomeryville, Pa. $1,346,170. Repair, update and/or refurbish AN/VPS-2 radar sets and components. DA-AA25-70-A-0470.

—The Army Missile Command, Huntsville, Ala., issued the following contracts:
Martin Marietta Corp., Orlando, Fla. $1,-011,003. Transitional training from P-1 to P-1A Pershing missile configuration for Federal Republic of Germany personnel. DA-AH01-70-C-1391.
AAI Corp., Cockeysville, Md. $2,583,726. Six AN/MPQ-T1 Nike Hercules simulators. DA-AH01-70-C-1315.

—Bell Helicopter Co., Fort Worth, Tex. $11,-

371, 724. UH-1N helicopters. DA-AJ01-70-C-0205. $6,297,814 (contract modification). Incorporation of ECP-UH-1-H33 crashworthy fuel systems. DA-AJ01-69-C-0028. Army Aviation Systems Command, St. Louis, Mo.

—The Edgewood Arsenal, Md., issued the following contracts:

Thiokol Chemical Corp., Woodbine, Ga. $1,161,781. CD-1 riot control agent. DA-AA15-70-C-0509.

Mine Safety Appliances Co., Pittsburgh, Pa. $2,868,860. M-2 filter panel infant protectors, Esmond, R.I. DA-AA15-70-C-0330.

—The Army Electronics Command, Fort Monmouth, N.J., issued the following contracts:

Fairchild Space and Defense Systems Corp., Syosset, N.Y. $1,887,000. 50 modification kits for AN/GLQ-3 equipment. DA-AB07-70-C-0305.

Texas Instruments, Inc., Austin, Tex. $1,500,000. Classified research and development equipment.

Watkins-Johnson Co., Palo Alto, Calif. $1,500,000. Classified research and development equipment.

Massachusetts Institute of Technology, Cambridge, Mass. $1,008,000 (contract modification). Basic and applied research in general physics, plasma, dynamics and communications flow sciences. DA-28-043-AMC-02536(E).

Honeywell, Inc., Tampa, Fla. $1,500,000. Classified electronic equipment.

TRW Colorado Electronics, Inc., Colorado Springs, Colo. $2,500,000. Classified electronic equipment.

Honeywell, Inc., St. Petersburg, Fla. $1,500,000 (contract modification). Classified electronic equipment. St. Petersburg and Tampa, Fla.

IBM Corp., Owego, N.Y. $8,500,000 (contract modification). Classified electronic equipment.

Collins Radio Co., Cedar Rapids, Iowa. $1,011,042. Components for AN/ARN-82 radio receiver sets. DA-AB07-70-C-0265.

Sperry Rand Corp., Phoenix, Ariz. $1,307,077. ID998 directional indicators and AM3209 amplifiers. DA-AB07-70-C-0328.

Burroughs Corp., Paoli, Pa. $1,115,000. Technical manuals for Automatic Message Processing System (AMPS) equipment. DA-AB07-70-C-0274.

General Dynamics Corp., San Diego, Calif. $1,283,766. 18-month study for the design of an Alerting Long Range Airborne Radar. DA-AB07-70-C-0341.

RCA, Burlington, Mass. $1,500,000. Integrated observation system (laser). DA-AB07-70-C-0340.

—**Maremont Corp.**, Saco, Maine. $7,814,506. 7.62mm machine guns, M60 series. Army Weapons Command, Rock Island, Ill. DA-AF03-70-C-0085.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., awarded the following contracts:

Kennedy Van Saun Corp., Danville, Pa. $1,385,100 (contract modification). Metal parts for 105mm M489 TP-T projectile. DA-AA-09-70-C-09.

Chamberlain Manufacturing Co., Elmhurst, Ill. $7,532,147 (contract modification). Metal parts for facilities to support production of 155mm and 175mm projectiles. Scranton Army Ammunition Plant, Pa. DA-36-034-AMC-0163(A).

Olin Corp., Stamford, Conn. $10,122,561 (contract modification). Operation and maintenance of government-owned facility for production of propellants at Badger Army Ammunition Plant, Baraboo, Wis. DA-AA-09-69-C-0014.

Chamberlain Manufacturing Co., Waterloo, Iowa. $1,705,887. Metal parts for 105mm, smoke, WP, M60 projectile. DA-AA-09-70-C-0437.

Day and Zimmerman, Inc., Philadelphia, Pa. $1,788,381 (contract modification). Operation and maintenance of government-owned facility for ammunition components at Kansas Army Ammunition Plant, Parsons, Kan. DA-AA-09-70-C-0245.

Atlas Chemical Industries, Inc., Wilmington, Del. $7,921,828 (contract modification). Operation and maintenance of government-owned facility for production of explosives at Volunteer Army Ammunition Plant, Chatanooga, Tenn. DA-11-173-AMC-531.

Harvey Aluminum Sales, Inc., Torrance, Calif. $3,299,820 (contract modification). Operation and maintenance of government-owned facility for loading, assembling and packing of ammunition. Army Ammunition Plant, Milan, Tenn. DA-11-173-AMC-520(A).

Hercules, Inc., Wilmington, Del. $3,021,990 (contract modification). Operation and maintenance of government-owned facilities for manufacture of rocket propellant at Sunflower Army Ammunition Plant, Lawrence, Kan. DA-11-173-AMC-72(A).

Day and Zimmerman, Inc., Philadelphia, Pa. $15,640,362 (contract modification). Operation and maintenance of government-owned facility and loading, assembling and packing of ammunition at Lone Star Army Ammunition Plant, Texarkana, Tex. DA-11-173-AMC-114A.

Uniroyal, Inc., New York, N. Y. $6,040,790 (contract modification). Operation and maintenance of government-owned facility for production of explosives, and loading, assembling and packing ammunition at Joliet Army Ammunition Plant, Joliet, Ill. DA-11-173-AMC-62 (A).

Mason and Hanger-Silas Mason Co., Inc., Lexington, Ky. $3,463,288 (contract modification). Operation and maintenance of government-owned facility, and loading, assembling and packing ammunition at Cornhusker Army Ammunition Plant, Grand Island, Neb. DA-AA09-68-C-0383.

Remington Arms, Inc., Bridgeport, Conn. $17,487,044 (contract modification). Operation and maintenance of government-owned facility for manufacture of small arms ammunition at Lake City Army Ammunition Plant, Independence, Mo. DA-49-010-AMC-3A.

Eastman Kodak Co., Holston Defense Corp., Kingsport, Tenn. $11,727,495 (contract modification). Operation and maintenance of government-owned facility for manufacture of explosives at Holston Army Ammunition Plant, Kingsport, Tenn. DA-11-173-AMC-35A.

Sperry Rand Corp., New York, N.Y. $11,192,135 (contract modification). Operation and maintenance of government-owned facility, and loading, assembling and packing ammunition at Louisiana Army Ammunition Plant, Shreveport, La. DA-11-173-AMC-80A.

Federal Cartridge Corp., Minneapolis, Minn. $1,229,730 (contract modification). Operation of government-owned facility for production of small arms ammunition at Twin Cities Army Ammunition Plant, New Brighton, Minn. DA-36-038-AMC-01099(A).

Mason and Hanger-Silas Mason Co., Inc., Lexington, Ky $4,546,384 (contract modification). Operation and maintenance of government-owned facility, and loading, assembling and packing ammunition at Iowa Army Ammunition Plant, Burlington, Iowa. DA-AA-09-68-C-0468.

Hercules, Inc., Wilmington, Del. $9,339,821 (contract modification). Operation and maintenance of government-owned facility for production of explosives and propellants at Radford Army Ammunition Plant, Radford, Va. DA-11-173-AMC-37(A).

Olin Corp., Stamford, Conn. $5,269,674 (contract modification). Operation and maintenance of government owned facility for production of propellant charges at Indiana Army Ammunition Plant, Charlestown, Ind. DA-AA-09-69-C-0148.

DEPARTMENT OF THE NAVY

1—**Raytheon Co.**, Sudbury, Mass. $48,326,270. Poseidon guidance system electronic assemblies and components. Waltham, Mass. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0055.

—**E. E. Black Ltd.**, Honolulu, Hawaii. $6,942,600. Sewage system improvements and sewage collection and treatment facilities, Public Works Center, Pearl Harbor, Hawaii. Naval Facilities Engineering Command, Washington, D.C. N62471-69-C-0469.

—**General Dynamics Corp.**, Pomona, Calif. $6,487,750. Modification and update of Standard ARM missiles for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-0529.

—**Dyson Construction Co.**, Pensacola, Fla. $2,212,793. Stock receiving facility, Naval Construction Battalion Center, Gulfport, Miss. Naval Facilities Engineering Command, Washington, D.C. N62468-70-C-0044.

2—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Pratt and Whitney Div., United Aircraft Corp., E. Hartford, Conn. $20,247,968 (contract modification). TF-30-P-100 engines for the Air Force. N00019-70-C-0208.

Gruman Aerospace Corp., Bethpage, N.Y. $23,000,000 (contract modification). Long lead time items for the EA-6B aircraft program. N00019-67-C-0078.

—**Johns Hopkins University**, Silver Spring, Md. $3,704,800. Increase level of effort for advanced research on the surface missile system. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604.

3—**FMC Corp.**, San Jose, Calif. $3,165,970. 942 assault amphibious landing craft, LVTP-7. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0281.

4—**Raytheon Corp.**, Wayland, Mass. $1,047,906. Installment funding for classified system engineering and weapon system design. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-4409.

5—**Logicon, Inc.**, San Pedro, Calif. $1,042,690. Computer programs and parts of computer programs for TACDEW and WARS. Fleet Computer Programming Center, San Diego, Calif. Naval Purchasing Office, Los Angeles, Calif. N00123-70-C-1468.

8—**Sperry Rand Corp.**, Syossett, N.Y. $10,670,000. Five prototype inertial navigation subsystem phase-shift units, spares and associated studies for the C-3 Poseidon missile conversion program. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5468.

—**Honeywell, Inc.**, Hopkins, Minn. $3,721,735 (contract modification). Mk 46 Mod 1 torpedoes. Naval Ordnance Systems Command, Washington, D.C. N00017-67-C-1102.

—**McDonnell Douglas Corp.**, Long Beach, Calif. $2,512,000 (contract modification). Long lead time items for the TA-4J aircraft program. Naval Air Systems Command, Washington, D.C. N00019-67-C-0170.

9—**Gall and Landau Construction Co., Braund Inc., and SS Contractors Inc.** (joint venture), Seattle, Wash. $3,444,500. 200 family housing units, Naval Shipyard, Bremerton, Wash. Naval Facilities Engineering Command, Washington, D.C. N62476-70-C-0052.

10—**Fontaine Brothers**, Springfield, Mass. $2,107,000. Temporary lodging facilities, Naval Base, Newport, R.I., and Naval Submarine Base, New London, Conn. East Central Division, Naval Facilities Engineering Command, Philadelphia, Pa. N62472-70-C-0094.

—The following contracts were awarded by the Naval Ship Systems Command, Washington, D.C.:

General Electric Co., Schenectady, N.Y. $4,440,000 (contract modification). Nuclear reactor compartment components. N00024-69-C-5154.

B. F. Goodrich Rubber Co., Akron, Ohio. $1,875,067. Six sonar Domes. N00024-70-C-1345.

11—**Collins Radio Co.**, Cedar Rapids, Iowa. $7,046,793. Communication, navigation and identification components for AN/ASQ-19B/56B/57B and 88B sets. Naval Air Systems Command, Washington, D.C. N00019-70-C-0475.

—The Naval Ordnance Systems Command, Washington, D.C., issued the following contracts:

Vitro Laboratories, Silver Spring, Md. $1,176,000. Increased level of effort for systems engineering and supporting services for the Surface Missile System Project. N00017-70-C-4417.

General Motors Corp., Milwaukee, Wis. $1,300,000. Warhead exploder assemblies for Mk 48 Mod 1 torpedoes, and associated equipment. N00017-70-C-1213.

12—Manpower, Inc., Milwaukee, Wis. $1,521,924. Mess attendant and food handling services for FY 1971, Naval Training Center, Great Lakes, Ill. Naval Administrative Command, Great Lakes, Ill. N00128-71-C-0001.

15—Sperry Rand Corp., Great Neck, N.Y. $1,050,000. 16 radar shelters and supporting data. Hq., Marine Corps, Washington, D.C. M00027-70-C-0147.

16—General Dynamics Corp., Pomona, Calif. $5,628,000 (contract modification). Standard ARM missiles and associated equipment for the Navy and Air Force. Pomona and Sycamore, Calif. Naval Air Systems Command, Washington, D.C. N00019-69-C-0336.

—Hunt Building Marts Inc., El Paso, Tex. $1,033,072. Construction of 100 family housing units, Marine Corps Air Station, Yuma, Ariz. Naval Facilities Engineering Command, Washington, D.C. N62473-69-C-0125.

17—Raytheon Co., Portsmouth, R.I. $9,172,535. Assembly and testing of nine AN/BQS-11/12 detecting and ranging sonar sets. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1325.

18—North American Rockwell Corp., Columbus, Ohio. $8,700,000 (contract modification). Parts and material for the RA-5C aircraft. Naval Air Systems Command, Washington, D.C. N00019-68-C-0190.

—Peterson Boatbuilding Co., Tacoma, Wash. $1,932,368. Four wood-hulled patrol craft (YP). Naval Ship Systems Command, Washington, D.C. N00024-70-C-0302.

—Woerfel Corp., Milwaukee, Wis. $5,992,995. Construction of an Omega Navigation station, La Moure, N.D. Chesapeake, Division, Naval Facilities Engineering Command, Washington, D.C. N62477-69-C-0095.

19—Peterson Builders, Inc., Sturgeon Bay, Wis. $5,562,855. Seven steel-hulled harbor tugs, YTB. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0301.

—Woods Hole Oceanographic Institution, Woods Hole, Mass. $1,895,199. Research in physical oceanography, marine geodesy, chemical oceanography, marine geology and geophysics, and instrumentation development. Office of Naval Research, Washington, D.C.

—The Navy Aviation Supply Office, Philadelphia, Pa., issued the following contracts for EA-6B/A-6E aircraft:

Fairchild Camera and Instrument Corp., Syosset, N.Y. $1,725,700. AN/ALQ-99 and AN/ASI-33 aircraft countermeasure equipment components and spare parts. N00383-70-C-5031.

General Instruments Corp., Hicksville, N.Y. $1,090,000. ALR-42 countermeasure system component equipment. N00383-70-C-4566.

Airborne Instrument Laboratories, Cutler-Hammer Corp., Deer Park, N.Y. $2,260,000. ALQ-99 countermeasure system component equipment. N00383-70-C-4565.

23—Kollsman Instrument Corp., Syosset, N.Y. $3,865,890. Advanced development model of a hydrographic survey and charting system. Naval Oceanographic Office, Washington, D.C. N62306-70-C-0150.

—Aluminum Co. of America, Pittsburgh, Pa. $2,098,878. Aluminum powder. Rockdale, Tex. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A155.

—Systems Associates Inc., Long Beach, Calif. $1,256,617. Carrier aircraft support study. Naval Air Engineering Center, Philadelphia, Pa. N00156-70-C-2013.

25—FMC Corp., Minneapolis, Minn. $21,041,433. Fabricate, test and prepare for shipment Mk 26 Mod 0 and Mod 1 guided missile launching systems. Fridley, Minn. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2209.

—Norden Div., United Aircraft Corp., Norwalk, Conn. $3,022,857. Long lead time items for use as initial spares for AN/APQ radar systems for A-6E aircraft. Navy Aviation Supply Office, Philadelphia, Pa. N00383-70-A-0503-0101.

—Dynamics Enterprises Inc., Dunn, N.C. $1,499,040. Labor and materials to perform mess attendant services, Pearl Harbor, for FY 1971-1973. Naval Supply Center, Pearl Harbor, Hawaii. N00604-70-C-0508.

—Johns Hopkins University, Silver Spring, Md. $1,301,617 (contract modification). Research on the Surface Missile System. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604.

—Regent Jack Manufacturing Co., Downey, Calif. $1,101,703. Aircraft jet engine installation and removal trailers. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-C-5618.

—Rohr Corp., Chula Vista, Calif. $1,375,535. Automated parts retrieval and storage systems for helicopters. Corpus Christi, Tex., and Chula Vista. Naval Air Station, Corpus Christi, Tex. N00216-70-C-0271.

26—Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $61,970,523 (contract modification). Refueling, overhaul and alterations to the USS Enterprise, CVAN-65. N00024-68-C-0293. $3,448,610. Advance planning, design work and long lead time material procurement preparatory to the overhaul and C-3 Poseidon conversion of the USS Simon Bolivar, SSBN-641. N00024-70-C-0262. $2,474,846. Work preparatory to the overhaul and C-3 Poseidon conversion of the USS James K. Polk, SSBN-645. N00024-70-C-0263. Naval Ship Systems Command, Washington, D.C.

—The Naval Ordnance Systems Command, Washington, D.C., issued the following contracts:

General Dynamics Corp., Pomona, Calif. $11,418,571. Long lead time items for Standard missiles. N00017-67-C-2107.

Sperry Rand Corp., Great Neck, N.Y. $1,683,600. Long lead time items for Terrier modernization program for DLG-20 and DLG-23 fire control systems, Mk 76 Mod 5. N00017-70-C-2315.

—Motorola Inc., Scottsdale, Ariz. $1,874,513. Product improvement program for the EX45 target detecting device. Navy Purchasing Office, Los Angeles, Calif. N00123-70-C-1410.

—HITCO, Inc., Gardena, Calif. $1,199,542. Classified submarine equipment. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5545.

29—Raytheon Co., Lexington, Mass. $16,322,387 (contract modification). Guidance and control units for Sparrow missiles for the Navy and Air Force. Lowell and Bedford, Mass., Bristol, Tenn., and Oxnard, Calif. Naval Air Systems Command, Washington, D.C. N00019-69-C-0358.

—Demetree Builders Inc., Jacksonville, Fla. $1,984,915. Construction of a domestic and industrial waste facility, Naval Air Station, Jacksonville. Naval Facilities Engineering Command, Washington, D.C. N62467-68-C-0203.

—DeLaval Turbine Corp., Trenton, N.J. $2,000,000. Fuel oil pumps, associated equipment and data for the Navy Standard Distillate Fuel Program. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5497.

—Bunker-Ramo Corp., Silver Spring, Md. $7,361,100. Spare components for the AN/ALQ-86 electronic countermeasures system for EA-6A aircraft. Canoga Park, Calif., and Silver Spring. Naval Air Systems Command, Washington, D.C. N00019-70-C-0587.

—Johns Hopkins University, Silver Spring, Md. $3,185,000 (contract modification). Increase the level of advanced research on the Surface Missile System. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604.

—Wickes Industries, Camden, N.J. $2,347,045. Air transportable air traffic control systems, AN/TSA-28A. Navy Purchasing Office, Los Angeles, Calif. N00123-70-C-0977.

30—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Bendix Corp., North Hollywood, Calif. $3,949,724. Sonar system components. N00019-70-C-0494.

Hughes Aircraft Co., Culver City, Calif. $4,000,000 (contract modification). Phoenix missile system program. Culver City, Los Angeles, El Segundo, Canoga Park, Calif., and Tucson, Ariz. N00019-69-C-0633.

Westinghouse Electric Corp., Baltimore, Md. $7,979,783 (contract modification). AN/APG-59 radar sets. N00019-70-C-0127.

Motorola, Inc., Scottsdale, Ariz. $3,135,000. Automatic Carrier Landing System beacon augmentor components. N00019-70-C-0565.

Honeywell, Inc., Minneapolis, Minn. $13,386,262 (contract modification). Rockeye II weapon system. N00019-70-C-0140.

—The following contracts were awarded by the Naval Ship Systems Command, Washington, D.C.:

Philco-Ford Corp., Willow Grove, Pa. $1,310,680. Computer card punch machines. N00024-70-C-1310.

Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $24,887,614 (contract modification). Preparation for, and overhaul, refueling and C-3 conversion of the USS Daniel Boone, SSBN-629. N00024-68-C-0260 PZ09. $24,721,520 (contract modification). Preparation for, and overhaul, refueling and C-3 conversion of the USS Tecumseh, SSBN-628. N00024-69-C-0215 PZ10.

Harbor Boat Building Co., Terminal Island, Calif. $9,139,061. Modernization and repair of five ocean minesweepers (MSOs). N0024-70-C-0309.

Sperry Gyroscope Div., Sperry Rand Corp., New York, N.Y. $2,377,000. Ships Inertial Navigation System (SINS), repair parts and associated technical data. Great Neck, N.Y. N00024-70-C-5594.

—The Naval Ordnance Systems Command, Washington, D.C., issued the following contracts:

Singer-General Precision, Inc., Glendale, Calif. $1,544,193. Ordnance alteration kits for Mk 101, 112 and 113/7 Fire Control System, in support of the Mk 48 torpedo program. N00017-70-C-1215.

General Dynamics Corp., Pomona, Calif. $1,206,000. Test equipment for the standard missile depot and level maintenance facility. N00017-70-C-0177.

—Interstate Electronics Corp., Anaheim, Calif. $1,939,500. Poseidon missile test instrumentation equipment. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0177.

—Hughes Aircraft Co., Fullerton, Calif. $4,203,681. Design and installation of a Marine Corps tactical air command and control test facility, Camp Pendleton, Calif. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3552.

DEPARTMENT OF THE AIR FORCE

1—Lockheed Aircraft Corp., Marietta, Ga. $14,004,200. C-5A aircraft spare parts. Detachment 31, San Antonio Air Materiel Area, Marietta, Ga. AF33(657)15053.

—General Motors Corp., Indianapolis, Ind. $21,233,510. TF-41-A-1 turbofan engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-67-C-0163-P105.

—General Dynamics Corp., Fort Worth, Tex. $1,099,385. Modification of electronic warfare evaluation simulators. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33615-70-C-1507.

2—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

General Electric Co., Philadelphia, Pa. $8,900,000. Research and development

of a Mk 12 reentry vehicle. AF 04(694)-975.
Raytheon Service Co., Burlington, Mass. $1,895,650. Improvement in radar equipment used in support of the Advanced Ballistic Reentry System (ABRES). F04701-69-C-0238.

3—General Electric Co., Philadelphia, Pa. $10,776,702. Research and development of the Mk 12 reentry system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF04(694)-731.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:
Lockheed Aircraft Co., Marietta, Ga. $2,733,141. C-5A aircraft aerospace ground equipment. AF33(657)-15053.
General Electric Co., West Lynn, Mass. $1,000,000. Aircraft engine component improvements. F33657-70-C-0545.

4—North American Rockwell Corp., Anaheim, Calif. $4,674,563. Design, development and fabrication of depot maintenance ground equipment, factory tooling, and test equipment in support of guidance and control systems for Minuteman III missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0129.

—Itek Corp., Palo Alto, Calif. $2,579,777. Aircraft radar component parts. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F04606-70-A-0021-RJ09.

5—Westinghouse Electric Corp., Baltimore, Md. $6,156,000. Design and development of tactical air defense systems and related ground equipment. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-70-C-0186.

—North American Rockwell Corp., Anaheim, Calif. $10,813,298. Design and development of a post boost control system for Minuteman III. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-68-C-0162.

8—General Dynamics Corp., Fort Worth, Tex. $50,000,000. F-111 series aircraft aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)13403.

—Reading Techmatic Corp., Reading, Pa. $3,848,000. De-icing and decontamination spray units and spare parts. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-70-D-7670.

10—North American Rockwell Corp., Canoga Park, Calif. $1,000,000. Atlas MA-5 propulsion systems. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0248.

11—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:
Lockheed Aircraft Corp., Marietta, Ga. $1,445,000. Building maintenance at Air Force Plant no. 6, Marietta. F33657-69-C-0727.
General Motors Corp., Indianapolis, Ind. $5,012,542. Improvement of T-56 turboprop engine components. F33657-70-C-0712.
Tec Data, Inc., Ventura, Calif. $1,550,-628. Base maintenance services, Los Angeles Air Force Station. F04693-70-C-0029.

12—Lockheed Aircraft Corp., Sunnyvale, Calif. $1,452,114. Research and development on the Air Force Satellite Control Facility, Sunnyvale. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0068.

—Lockheed Aircraft Corp., Marietta, Ga. $4,848,880. Spare parts for C-5A aircraft. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. AF33(657)-15053.

—General Dynamics Corp., Fort Worth, Tex. $126,971,000. Adjustment of billing prices and increase in liquidation rate. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-13403.

—The Boeing Co., Seattle, Wash. $5,416,870. Force modernization of Engineering Test Facilities I and II, Hill AFB, Utah. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0140.

15—Allen M. Campbell Co., General Contractors, Inc., Tyler, Tex. $5,119,000. Site development and construction of 300 family housing units, Eglin AFB, Fla. Procurement Division, Eglin AFB, Fla. F08651-70-C-0420.

16—Hallicrafters Co., Rolling Meadows, Ill. $1,008,500. QRC-128A(T) electronic countermeasure equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0944.

—Hughes Aircraft Co., Fullerton, Calif. $2,-250,000. Development of computer equipment for use in a tactical data system. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-70-C-0189.

—Westinghouse Electric Corp., Cockeysville, Md. $1,629,000. Radar test equipment. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F34601-70-A-0705QP26.

17—Burroughs Corp., Washington, D.C. $1,-026,910. Electronic data processing equipment. Pasadena, Calif. Procurement Division, Wright-Patterson AFB, Ohio. F33600-70-F-7242.

18—Lockheed Aircraft Corp., Marietta, Ga. $50,000,000. C-5A development. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-15053.

—The Boeing Co., Seattle, Wash. $2,000,000. Design, development, study and test programs for Minuteman missiles. Space and Missiles Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0153.

19—Cessna Aircraft Co., Wichita, Kans. $1,-177,000. A-37B aircraft spare parts and aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-67-C-0824.

—General Motors Corp., Indianapolis, Ind. $6,604,630. T-56-A-7B turboprop engines, spare parts, aerospace ground equipment, modification kits and data. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0500.

22—General Electric Co., Philadelphia, Pa. $2,-000,000. Research and development of the Mk 12 reentry vehicle. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF 04-694-975.

23—Philco-Ford Corp., Palo Alto, Calif. $4,-432,812. Engineering support for the Air Force Satellite Control Facility Network. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0029.

24—Lockheed Aircraft Corp., Marietta, Ga. $4,908,962. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657)-15053.

—General Electric Co., Philadelphia, Pa. $1,-999,678. Research and development on the Mk 12 reentry system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. AF04(694)-916.

25—American Electric, Inc., La Mirada, Calif. $3,947,930. Air munitions. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-728.

26—General Electric Co., Cincinnati, Ohio. $1,-571,148. Spare parts for TF-39 engines for the C-5A. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. AF33(657)-15003.

—Raytheon Co., Burlington, Mass. $3,120,-220. Operation and maintenance of 440L over-the-horizon-radar sites. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-70-C-0203.

—Koppers Co., Inc., Baltimore, Md. $2,187,-470. Noise suppression equipment for use in ground testing aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-1154.

—The Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla., issued the following contracts for field team services for the maintenance/modification of various weapon systems at world-wide Government installations:
Qualitron Aero, Inc., Fort Worth, Tex. $1,000,000. F34601-70-D-3562.
Dynalectron Corp., Fort Worth, Tex. $1,000,000. F34601-70-D-3563.
Lear Siegler, Inc., Oklahoma City, Okla. $1,000,000. F34601-70-D-3574.

29—The following contracts were awarded by the Space and Missile Systems Organization, AFSC, Los Angeles, Calif.:
United Technology Center, Div. of United Aircraft Corp., Sunnyvale, Calif. $12,947,307. Titan III C/D solid fuel rocket motors. F04695-67-C-0120.
Martin Marietta Corp., Denver, Colo. $10,947,039. Design, development, fabrication and delivery of Titan IIIC space booster and associated aerospace ground equipment. F04701-70-C-0202.
Massachusetts Institute of Technology, Cambridge, Mass. $5,500,000. Development of third generation inertial guidance equipment for missile systems. F04701-70-C-0276.

—The Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio, has issued the following contracts:
Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y. $1,019,700. Advanced development of command and control systems. F33615-70-C-1600.
General Dynamics Corp., Fort Worth, Tex. $6,683,999. Aerospace ground equipment for F-111D aircraft. AF33(657)-13403.

—The Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla., has awarded the following contracts:
Hayes International Corp., Birmingham, Ala. $1,365,696. Inspection, repair and modification of KC-135 aircraft. F34601-68-C-3607.
Futuronics Corp., Port Washington, N.Y. $2,935,700. Mobile communications vans. F34601-70-C-3556.

—Bendix Corp., Baltimore, Md. $2,290,000. Technical services to support equipment used in tracking space vehicles, Baltimore and Colorado Springs, Colo. Aerospace Defense Command, Colorado Springs, Colo. F05604-70-C-0010.

30—The Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif., awarded the following contracts:
Lockheed Aircraft Service Co., Lockheed Aircraft Corp., Ontario, Calif. $14,-920,000. Maintenance of F/TF-104G aircraft at Luke AFB, Ariz. F04707-71-C-0019.
Solar Div., International Harvester Co. $5,048,462. Turbine engine driven electrical power plants and generator sets. F04606-68-D-0643.

—Radiation, Inc., Melbourne, Fla. $2,595,-000. Electronic equipment. Palm Bay, Fla. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0251.

—Communications Div., ITT, Nutley, N.J. $1,370,000. Maintenance training and support of Air Force personnel for the Strategic Air Command automated command control system. Offutt, Barksdale and March AFBs and Nutley, N.J. Procurement Div., Offutt AFB, Neb. F25600-70-C-0400.

—Concrete Pavers, Inc., Tampa, Fla. $1,-380,025. Repair of runway at MacDill AFB, Fla. Procurement Div., MacDill AFB, Fla. F08602-70-C-0175.

—Singer General Precision, Inc., Silver Spring, Md. $3,094,000. Modification kits and related data for flight simulators for KC-135 aircraft. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-1359.

—Sikorsky Aircraft Div., United Aircraft Corp., Stratford, Conn. $4,723,619. Modification kits for main rotor blades of H-3 series of helicopters. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. N00019-70-A-0002.

—Spillyard Machinery Co., San Antonio, Tex. $1,125,000. Furnishing and installation of a storage aid system in an existing building at Kelly AFB, Tex. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41699-70-C-0747.

—Carnegie-Mellon University, Pittsburgh, Pa. $1,800,000. Research in information processing. Office of Scientific Research, Arlington, Va. F44620-70-C-0107.

—Univac Federal Systems Div., Sperry Rand Corp., St. Paul, Minn. $1,500,000. Maintenance and rental of automatic data processing equipment. Carswell AFB, Tex. Air Force Communications Service, Scott AFB, Ill. F11628-69-C-0027.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., has awarded the following contracts:
Massachusetts Institute of Technology, Cambridge, Mass. $1,300,000. Advanced development of the Minuteman guidance system. AF04(694)-909.
Aerojet-General Corp., Sacramento, Calif. $4,473,209. Production of Titan IIIC third stage engines. F04701-68-C-0267.

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AVCO Corp., Greenwich, Conn. $2,475,-888. Fabrication and testing of Mark 11C Minuteman reentry vehicle. Stratford, Conn. F04701-69-C-0242.

Aerojet-General Corp., Sacramento, Calif. $12,100,000. Titan III B/C/D Stage I and II liquid rocket engine systems. F04701-70-C-0095.

Silvania Electronic Systems, Waltham, Mass. $1,440,343. Services and supplies to support Minuteman ground electronics system. F04701-69-C-0220.

—The Boeing Co., Seattle, Wash. $4,900,000. Long lead effort and data to support FY 1971 production buy of short range attack missile (SRAM). Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0876.

Air Force R & D

(*Continued from page 29*)

the Air Force. This research encompasses every scientific discipline that is relevant to the continued superiority of the Air Force operational capability. It is the mission of AFSC to manage this large and diverse program, not only to assure that research dollars are spent wisely, but also to disseminate the results of this research to government and nongovernment scientific communities. Therefore, AFSC has taken over OAR's Management and Scientific Information System (MASIS).

MASIS is a computer-based system which accumulates data on the many research efforts comprising the Air Force's research program. MASIS data is organized into four master files—proposal, fiscal, narrative, and publication—which correspond to the stages associated with the selection and performance of research.

Expansion of DOL

Before the merger, AFSC's Directorate of Laboratories (DOL), was structured with a director, deputy director, and four directorates to manage AFSC's nine laboratories and their diverse programs. The directorates were Laboratory Plans and Programs, Science and Technology, Technology Applications and Technical Liaison.

To adjust to the added responsibilities of furnishing guidance to the four new major laboratories gained in consolidation, and applying the laboratories' work to the needs of the Air Force, the Director of Laboratories now has two deputies, one for research and one for technology. The Deputy Director for Research, who has not been named at presstime, will be primarily concerned with the new basic research laboratories and the research activities of the others. The Deputy Director for Technology is Peter R. Murray, former AFSC Deputy Director of Laboratories. He will be primarily concerned with the nine AFSC laboratories in existence prior to the merger, and the technological aspects of the four new laboratories.

The previous Science and Technology Directorate of DOL has been renamed the Technology Directorate, and a new Directorate of Science has been created.

Brigadier General Raymond A. Gilbert, who has been AFSC's Director of Laboratories since April 1967, retired July 31. Major General Paul T. Cooper, AFSC's Chief of Staff since August 1968, will become Director of Laboratories upon General Gilbert's retirement.

Space Weather Forecasts Begin

The Air Force now has a space weather forecasting system in operation.

More than 50 ground-based stations all over the world transmit teletype data as a direct input to a system of four UNIVAC 1108 computers at the Air Force Global Weather Central at Offutt AFB, Neb. Satellite data is also a direct input to the system. The data consists of solar activity, solar emissions, and solar-induced geomagnetic and ionospheric changes in the earth's environment. The computer processes these data as a basis for forecasting changes in the earth's environment affecting Air Force communications, navigation, and surveillance systems.

The Air Weather Service and the Air Force Cambridge Research Laboratories together established uniform observing and reporting procedures and designed carefully calibrated instruments to provide standardized information. With this system, predictions of solar-terrestrial effects will be made with greater accuracy and for longer periods in advance, and it may prove of value in furthering knowledge of how specific solar variations translate into a specific set of terrestrial effects.

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DOD Establishes Office of Health and Environment

Secretary of Defense Melvin R. Laird has announced the establishment of the Office of Assistant Secretary of Defense for Health and Environment. Dr. Louis M. Rousselot, presently serving as Deputy Assistant Secretary of Defense (Manpower and Reserve Affairs) for Health Affairs, has been nominated by President Nixon for the new position.

The Assistant Secretary for Health and Environment will be the principal staff advisor and coordinator for the Secretary of Defense for health and sanitation matters throughout the Defense Department. This includes the care and treatment of patients, preventive medicine, clinical investigations, hospitals and related health facilities, medical material, and nutrition and health personnel, including their education, training and retention.

Responsibility for environmental quality matters, previously under the Office of the Assistant Secretary of Defense (Installations and Logistics) [OASD(I&L)], will be added to the functions of the new assistant secretary. These responsibilities will include coordination of defense matters regarding environmental quality with other appropriate agencies.

Also among the new secretary's functions
be recognition of environmental quality probl
related to the development, production and us
new materials, and providing guidance to ins
their abatement and control. The office will
consult with other government officials for p
ning new activities to ensure that the best av
able techniques and methods are used for the
tection of the environment.

Responsibility for the Defense Departme
Natural Resource Program, which includes de
opment, protection and conservation of forest
other vegetative cover, and soil and water con
vation programs on military installations,
remain with OASD(I&L). This includes proj
for prevention, control and abatement of envi
mental pollution.

The new position was authorized by Public
91-121, signed Nov. 19, 1969. Policy guidanc
pollution control at federal facilities was prov
for in Executive Order 11507, issued Feb. 4, 1

Dr. Rousselot was a Professor of Clinical
gery at New York University School of Medi
and Director of Surgery at St. Vincent's Hos
and Medical Center, New York City, prior t
appointment to the Defense Department in J
ary 1968.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1970 43

DEFENSE INDUSTRY BULLETIN

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DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 9 September 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds approved by the Director, Bureau of the Budget, Nov. 2, 1965.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

IN THIS ISSUE

FEATURES

DEPARTMENTS

Experiences in Incentive Contracting

Captain William K. Jones, USAF

The large number of cost and performance tradeoffs inherent in multiple incentive contracts often cause confusion and misunderstanding on the part of both government and contractor personnel. Recognizing the need for clearer communication in such contracts, the Assistant Secretary of Defense (Installations and Logistics) established a special agency under the Air Force to analyze and structure proposed multiple incentive arrangements for the Army, Navy and Air Force, and to conduct research in incentive contracting and related subjects.

This special agency, called DOD Program Office for Evaluating and Structuring Multiple Incentive Contracts (POESMIC), became operational in April 1968 at the Space and Missile Systems Organization in Los Angeles. Shortly thereafter, each military service instituted a policy requiring that all multiple incentive contracts over $5 million be structured with the aid of POESMIC.

(See "Improved Performance is Goal of Multiple Incentive Contracts" by Francis J. Hines, *Defense Industry Bulletin*, January 1969, page 5.)

To date, POESMIC has evaluated or structured over 150 incentive arrangements for the military departments and the National Aeronautics and Space Administration. This article communicates first hand experience on the subject of incentive contracting.

During two and one-half years of working with multiple incentive contracts, POESMIC has seen many types of incentive structures. Most of these structures provided the communication between Government and contractor that is necessary for effective performance on contracts. Others, however, failed to communicate government objectives clearly and would have led to subsequent confusion and misunderstanding on the part of both contracting parties.

The less effective incentive structures contained errors that occurred repeatedly. We have developed a list of the most common errors, analyzed their causes, and studied their adverse implications. This article relates our findings; it discusses the errors that were found to be most prevalent and suggests ways to avoid them.

Implied Value

The cause of most structuring problems is a misunderstanding of the concept of "implied value." An understanding of this concept by contracting personnel will help eliminate many of the mistakes that hamper incentive arrangements.

The purpose of an incentive structure is to communicate the value the Government places on improvements in incentive parameters, such as cost, speed, reliability, and schedule. Because the structure is a guide to the relative value of incentive parameters, the desired contract performance can be determined by the weighting the Government assigns to each parameter. Contracting personnel should, therefore, understand how implied value is related to an incentive structure.

Imagine a Cost Plus Incentive Fee (CPIF) contract with the parameters listed in Table 1 (see page 2). The relative worth or value of performance increases on the incentive parameters is implicit in this table. For example, to determine the worth to the Government of an increase in air speed from 1,200 to 1,250 knots, it is necessary to examine the effect of increases in air speed along with the effect of increases in cost on net fee.

As the contractor increases air speed

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Table 1

Cost Incentive

Target Cost	$100 million
Target Fee	$8 Million
Cost Range of Incentive Effectiveness	$90 Million to $120 Million
Sharing Ratio	80/20

Performance Incentives

	Minimum	Target	Maximum
Air Speed (knots)	1,200	1,250	1,350
Incentive Fee	—$2 million (2%)	0	$2 Million (2%)
Weight (pounds)	25,000	20,000	18,000
Incentive Fee	—$2 Million (2%)	0	$1.5 Million (1.5%)
Altitude (feet)	50,000	55,000	60,000
Incentive Fee	—$3 Million (3%)	0	$1 Million (1%)

Schedule Incentive

Delivery	8 Weeks Late	On Time	4 Weeks Early
Incentive Fee	—$0.5 Million (0.5%)	0	$0.5 Million (0.5%)

Table 2

Air Speed	Implied Value
Increase from 1,200 to 1,250 knots (target)	$10 Million
Increase from 1,250 to 1,300 knots	5 Million
Increase from 1,300 to 1,350 knots	5 Million
Weight	
Decrease from 25,000 to 20,000 pounds (target)	$10 Million
Decrease from 20,000 to 18,000 pounds	7.5 Million
Altitude	
Increase from 50,000 to 55,000 feet (target)	$15 Million
Increase from 55,000 to 60,000 feet	5 Million
Schedule	
Improve from 8 weeks late to 4 weeks late	$1.25 Million
Improve from 4 weeks late to target date	1.25 Million
Improve from target date to 4 weeks early	2.50 Million
Total Performance and Schedule	
Value of increasing from minimum to target	$37.5 Million
Value of increasing from target to maximum	25 Million

capability from 1,200 to 1,250 knots, he is rewarded 0.4 percent (avoids a penalty of 0.4 percent) of target cost for each 10-knot increase. At the same time he is penalized (by the 80/20 sharing ratio) 20 cents of each dollar he spends. By increasing air speed 50 knots, he earns 2 percent additional fee. If he spends an additional $10 million in the effort, he loses 2 percent of target cost for the cost increase. Ten million dollars, then, is the implied value or worth of increasing air speed from 1,200 knots to 1,250 knots: the fee *gained* by improving performance is exactly offset by the fee *lost* by increasing costs. Thus, if a contractor can achieve the improved performance at a cost less than $10 million, his net fee will be increased. In the same way, dollar values can be computed for improvements on all the performance and schedule parameters. Table 2 shows the results of such calculations.

Incentive structures can be used not only to determine the relative worth of different parameters, but also to assess tradeoff relationships among the *non-cost* parameters. For example, a contractor may wish to know how many additional *weeks* he can devote to increasing *air speed* from 1,237.5 to 1,250 knots. Table 1 implies that the 12.5-knot increase is worth 0.5 percent fee. If the contractor is eight weeks late in delivery, he will lose 0.5 percent fee. Thus, the 12.5-knot improvement in air speed is worth an 8-week slip in schedule.

The total available fee pool should be allocated among incentive parameters in accordance with their relative worth, so that a contractor is more likely to make the tradeoff decisions among cost, performance, and schedule that are actually desired by the Government. In this way, no matter how the contractor trades off, he will be rewarded in accordance with how well he achieves the government's goals.

Assume that the Government determined the relative importance of cost, reliability, and schedule on a particular procurement to be 4 to 2 to 1, respectively. If the total fee swing was between 1 percent and 15 percent, then 8 percent would be allocated to cost, 4 percent to reliability, and 2 percent to schedule. This example

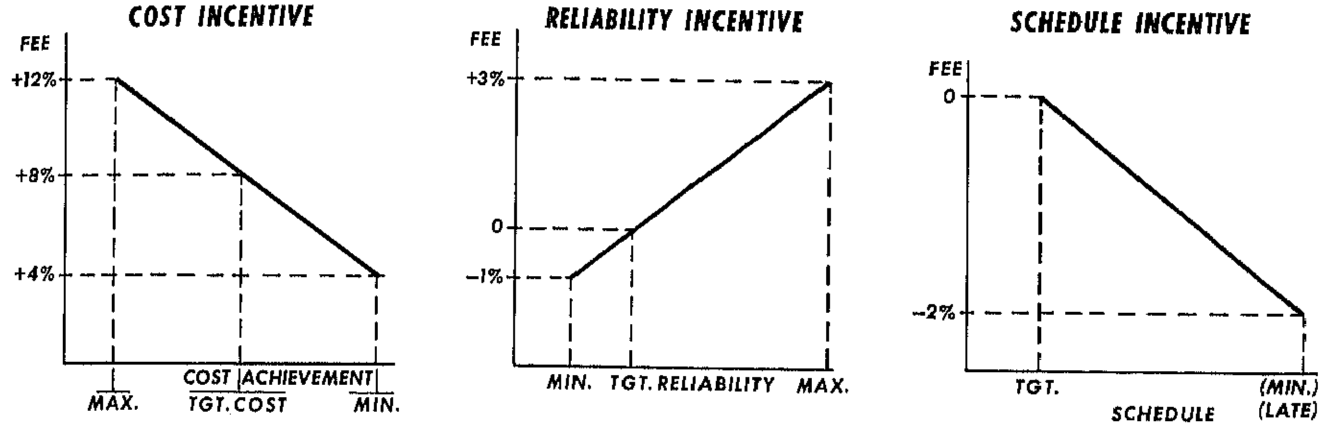


Figure 1.

shows that "fee allocation" means allocating the fee *pool*—it does *not* mean allocating the target fee. The target fee is established on the cost incentive parameter; the non-cost parameters then show how levels of achievement above and below target performance or schedule either add to or subtract from target fee. The target level of achievement for each non-cost parameter, therefore, should correspond to zero fee added or subtracted. Figure 1 illustrates this concept, using the 4 to 2 to 1 weighting described before and assuming a target fee of 8 percent.

Maximum fee should correspond to the maximum worth to the Government and should *not* be the amount considered necessary to motivate a contractor to achieve highest performance. Since contractors all have different motivations, maximum fee may not be large enough to motivate a particular contractor. Motivating him could require more money than the government's estimation of worth would allow. Clearly, the goal of communicating worth takes precedence over the goal of motivation when the two conflict.

The best way to structure incentives is through repeated iteration: after a "trial" incentive arrangement is developed, the implied values of incentive parameters are determined. If any of the implied values are unacceptable, the amount of money placed on the incentive parameters is gradually changed until acceptable values are attained. The Cost-Performance Correlation Method, outlined in Chapter 4 of the 1969 "DOD/NASA Incentive Contracting Guide" is one such iterative scheme.*

Common Errors

The usefulness of incentive contracts is dependent upon the degree of mutual understanding of incentive goals between Government and contractor. There are some practices that adversely affect incentive arrangements by distorting their implied value and by increasing their complexity, thus decreasing the level of mutual understanding. Following is a discussion of these errors.

Improper Ranges of Incentive Effectiveness. The range of incentive effectiveness (RIE) for each incentive parameter, such as cost, speed, reliability, and schedule, is defined as the area that surrounds the target level of achievement, and that is confined by the "minimum" and "maximum" achievement levels. As will be shown later, careful choice of minimum and maximum levels is important, because these points define for the contractor the regions of acceptable cost, performance, and schedule outcomes.

Two definitions are in order. The *minimum* level achievement is defined as the least desirable attainment that is still acceptable to the Government. The *maximum* level of achievements is the most desirable attainment; it is a level that will enhance the overall system and that can be attained by the contractor within his technological capability.

What, then, are the implications of an improper RIE? If the minimum levels on individual parameters are not established in consideration of the overall system, and if the least desirable level is achieved on *all* incentive parameters, the *combined* system may be unacceptable.

Maximum levels are a different matter. Because superior achievement is costly, government contracting personnel must ensure that such achievement is actually needed. For example, if an aircraft altitude capability of 50,000 feet is sufficient to ensure mission accomplishment, it would be unwise to apply incentives to achieve a higher capability. Similarly, incentives should not be applied to accelerate the schedule without first deciding whether improvements in delivery date have value. When several components must be brought together to form a system, early delivery of only one component is valueless. Clearly, incentive dollars should not be placed on high achievement levels that are either unattainable by the contractor or unneeded by the buying agency.

The cost RIE should be the range of *probable* costs and not the range of all *possible* costs. Theoretically, costs can vary infinitely; an incentive arrangement is concerned only with probable outcomes. When the underrun range on the cost incentive is too large, the incentive fee to be paid for low costs

**Copies of "DOD/NASA Incentive Contracting Guide" are available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, $2 per copy (Order No. 0-364-685).*

will be unreachable and, therefore, wasted. Often, these incentive dollars could be applied to the performance or schedule parameters. Effective allocation of fee is particularly important on a CPIF type contract since the maximum fee is usually limited.

Naturally, the size of the RIE is closely related to the nature of the procurement. Complex procurements, such as those involving heat-resistant metals, optical equipment and lasers, which require extensive scientific research, may need broader cost ranges than more common procurement items.

Improper Choice of Target Levels of Achievement. Target achievement levels on the non-cost incentive parameters, *e.g.*, speed, reliability, and schedule, should be chosen before the target cost is established. Target levels should be placed somewhere between the minimum and maximum achievement levels in accordance with procurement objectives. The target level on the cost parameter is then determined, based upon the selected target levels of the non-cost parameters. In other words, contracting personnel will decide how much it will cost to achieve the target levels on the non-cost parameters and then make *that* amount the target cost.

In many cases, contracting personnel feel that symmetry is necessary: they place the target level for all incentive parameters at the midpoint of heir respective RIEs. Such a practice be detrimental to the effectiveness n incentive structure. If a particu- structure incentivizes cost up to 20 ent above target cost, it is not necessary that cost be incentivized down to 20 percent below target since the range of a potential underrun seldom equals the range of a potential overrun. In the case of "rewards only" incentives, the target level is the minimum level; and, in "penalty-only" incentives, the target level is the maximum level.

Complex Formulas. Complicated mathematical formulas for gauging achievement levels and determining fees is a less common but serious problem area. Complex formulas are difficult to understand. Furthermore, unnoticed errors may be included that distort intended results. In many cases, complicated formulas require more interpretive effort than would have been necessary without the formula. Because complicated mathematical formulas increase the chances of error and misinterpretation, they should be assessed carefully for correctness and merit and used in incentive structures only when their value is clearly evident.

Multiple Sharing Ratios. Multiple sharing ratios (also called "step" sharing ratios), within the range of incentive effectiveness, are another common trait of incentive arrangements. Multiple sharing ratios complicate incentive arrangements by changing the implied "value" of performance improvements. When sharing ratios vary throughout the RIE, tradeoff relationships between cost and performance parameters change so that the same increment of increased performance has a different value depending on its cost position. Figure 2 illustrates this concept. Unfortunately, multiple sharing ratios are often applied arbitrarily. In general, the value of a given performance increase is constant; consequently, there should be only one sharing ratio.

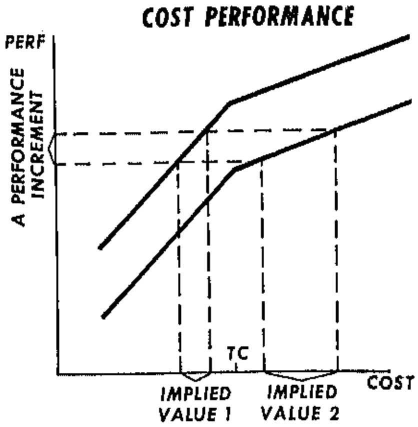


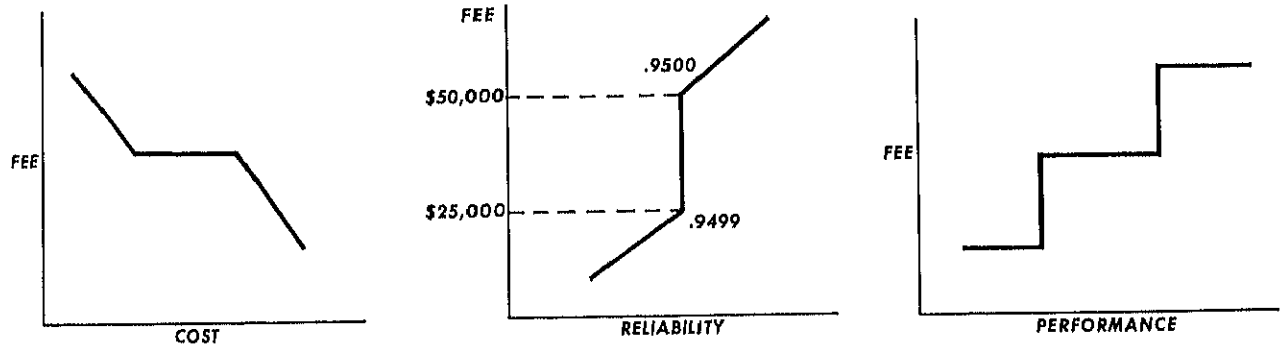
Figure 2.

Cost/Performance Tradeoff (Iso-Fee) Graph

This figure could represent, for example, an incentive arrangement having a 60/40 sharing ratio for costs under target cost (TC) and an 85/15 sharing ratio for costs over target cost.

Graphical Discontinuities. Another problem area is graphical discontinuities, or "flat spots," which often occur on achievement versus fee graphs. There are two types of flat spots—horizontal and vertical. In addition, there is a closely related form called "step functions."

Consider the graphs in Figure 3. *Horizontal* flat spots usually occur on cost incentive parameters (Graph 1),



Graph 1. Graph 2. Graph 3.

Figure 3.

These flat spots are areas where the government/contractor sharing ratio is at, or close to, 100/0. Often, flat spots result from an attempt to limit the contractor's risk near target cost. In this situation, contracting personnel are not able to select a target *point*, so a *region* is established within which the actual cost is expected to fall.

Contracting personnel often do not realize the implications of a flat spot on the cost parameter, namely, that it destroys the tradeoff relationships within that area. Along the flat spot there is no penalty for increasing costs, so the value of improved performance and schedule is unlimited.

There is never a logical justification for a horizontal flat spot on the cost incentive parameter. In fact, the area close to target cost provides the greatest opportunity for a meaningful incentive.

Usually, *vertical* flat spots occur on performance parameters (Graph 2). They result from an attempt to define a level of achievement below which the contractor's reward is greatly reduced and above which his reward is greatly increased. Seldom is such a fee jump at one point justified. The vertical flat spot destroys tradeoff relationships because it implies that for a small increase in performance the contractor can spend a great amount of money. For example, within the arrangement depicted on Graph 2, the contractor receives an extra $25,000 for increasing reliability from .9499 to .9500. Assuming that the sharing ratio is 80/20, the contractor can spend $125,000 to increase reliability only 0.01 percent without losing fee.

The third form of graphical discontinuity, *step functions*, is found on both performance and schedule incentives (Graph 3). In many cases, step functions are unavoidable and not harmful, as when they are used for small, discrete levels of measurement. However, when the steps extend over large intervals, they imply that there exist points of infinite value change followed by areas of indifference to improvements.

Step functions also increase the contractor's risk. This is because the contractor receives no increase in profit until an extremely large improvement in performance or schedule achievement is made. For this reason, the contractor may be hesitant to improve performance, if he fears he may not be able to reach the next higher step.

Excessive Parameters. Excessive performance and schedule incentive parameters are characteristic of many incentive structures. There are two causes of excessive parameters. The first is that contracting personnel often attempt to cover all performance contingencies. While thoroughness is desirable, failure on the part of contracting personnel to identify the most critical performance goals and to limit incentive parameters to those goals can lead to undesirable consequences. The second cause is that contracting personnel often use incentives as a vehicle to ensure that single, specified levels are achieved. Clearly, application of incentives to performance and schedule parameters should occur only when a range of acceptable levels has value to the Government.

When confronted with a large number of parameters, contractors have difficulty directing their attention to the most meaningful ones—the ones that truly represent the government's goals. The number of tradeoff decisions becomes enormous. Furthermore, a large number of parameters increases the possibility of suboptimization of individual parameters at the expense of *overall* optimization. Finally, excessive incentive parameters lead to increased administrative expense, since it becomes a difficult and time consuming task to monitor and assess achievement in the many individual areas.

It is often possible to limit the number of parameters by combining many small goals into one that *speaks* for all the others or is a *result* of all the others. Careful consideration of contracting goals will help eliminate unnecessary incentive parameters and, thereby, avoid confusion and suboptimization; and will help eliminate much of the government's cost associated with monitoring and measuring achievement on numerous parameters.

In summary, multiple incentive contracts are important procurement tools which, when properly structured, can effectively communicate government goals. There are misconceptions and common errors, however, that hamper communications. This article has attempted to clear up the misconceptions and to indicate ways to avoid the common errors.

POESMIC's services are available to all DOD and NASA agencies. Assistance in evaluating or structuring incentive arrangements can be acquired by writing: Headquarters, Space and Missile Systems Organization, Attn: SMKPD, Air Force Unit Post Office, Los Angeles, Calif. 90045.

Low Pollution Auto Engine Tested

A lean fuel mixture engine that will cut fuel costs and pollution is undergoing test and development at the Army Tank and Automotive Command (TACOM), Warren, Mich.

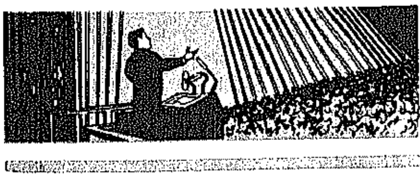
A combustion process, labeled Hybrid, that this engine uses combines the unthrottled, efficient operation of the diesel engine with the soft, controlled combustion of the spark ignition engine. The fuel needed to operate the engine at any given horsepower output requirement is injected into each cylinder. The charge within each cylinder is "stratified," with a stoichiometric mixture close to the spark plug and a leaner mixture further away. Complete combustion is achieved at lower temperatures, reducing high temperature production of such pollutants as nitrous oxide. With more complete combustion, less fuel is required. Laboratory engineers estimate that fuel costs can be cut 20 to 40 percent.

The engine will have the capability of using more than one kind of fuel.

To date, the Hybrid combustion principle has been applied only to the Army's ¼-ton M151 jeep, which is powered by a 4-cylinder engine displacing 141 cubic inches.

Tests have indicated that with this process engine emissions already meet proposed Federal exhaust emission standards for 1975. With unleaded fuel and a catalytic reactor, emissions can be reduced to the proposed 1980 levels without any further advances in combustion control.

The engine is expected to be in production by 1975.



FROM THE SPEAKERS ROSTRUM

Logistics Management Challenges in Weapon System Design

Address by Hon. John S. Foster Jr., Dir., Defense Research and Engineering, at First Annual Summer Meeting of the Logistics Management Advisory Committee, National Security Industrial Association, Absecon, N.J., June 29, 1970. [This address was read by Vice Admiral Vincent P. de Poix, Dep. Dir., Defense Research and Engineering, in the absence of Dr. Foster who was unable to attend the meeting.]

I would like to separate my talk this morning into three major parts: first, a brief sketch of future trends in product development—or to say it another way—a description of new Defense Department approaches to the acquisition of major weapon systems; second, some of the more significant problems in achieving our objectives; and third, some of the things which logistic support people can do to help us, and to help themselves, as we design and produce the major defense weaponry of the future.

Let us then begin with the product of the 1970s. It is most important to understand that nothing will improve, nothing will happen to better our future performance, unless we will it so—unless we dedicate ourselves to the job of seeing that it does occur. By the same token, that which is undesirable in the way we now conduct our business will remain with us unless we take positive action to get rid of it. Very simply stated, this means that the product of the 1970s will turn out to be exactly what we consciously make it to be—nothing more, nothing less.

Recently I had an opportunity to talk in Washington about six essential ways to maintain technological leadership in the service of our national goals. I would like to quote one of these six ways now, because it will explain the course of action which I feel we must take. I quote:

"... we must revamp—and thoroughly—the design philosophy in every corner of the Defense Department and defense industry. This task falls within my responsibilities—and there is no other matter about which I feel more strongly. We shall not in the future indulge in the present syndrome of incorporating into every system the most advanced technology, as soon as it seems to be available or merely because it is advanced. We shall ask only for what we really need—the minimum necessary performance—and we shall match, wherever possible, proven technology to that essential, realistic need. We shall insist relentlessly—as a point without peer in our management—that price has as much priority as performance. This does not rule out vigorous pursuit of new technology where that technology is required or can pay its way. And frequently new technology can be used to reduce costs. Yet we must design-to-a-price, a much lower price, or else we will not be able to afford what we need. Defense budgets are going down. The costs of what we need, just our essential needs, are going up. Our only solution is to make cost a principal design parameter. That is how we must define what is best. We have no other choice."

I have quoted from a talk I made some months ago in order to emphasize one of the most fundamental changes we must make in product character for the 1970s—that of treating cost as a major system objective.

Dr. John S. Foster Jr.

We have talked about this before, but we haven't really been successful in *doing* it. It is the *doing* that will cause some pain to everyone who gets involved, but especially to the engineering community. It will necessitate self-discipline and dedication of the highest order. It will cause a restructuring of our individual sets of priorities. It will necessitate the development of new capabilities and new points of view. We must learn that the simpler and less expensive products are often the best products—not shoddy goods at all.

Another major change in product character is that each must be adequate and acceptable in terms of mission worth but no more than that. This means that the translation of true operational need into stated operational requirements must also be scrutinized to ensure that we ask for no more than we need in the way of performance. Further, every stated operational requirement must be subject to re-evaluation as the engineering design emerges. It is at this point where, by virtue of actual tradeoff activity, we can evaluate the cost implications of the conversion of each individual stated operational requirement in terms of anticipated opera-

tional hardware. This is where tradeoffs can be meaningfully made—when price tags are attached to requirements, so that the most expensive ones become fully visible.

Another point that needs to be made is that all of us, including the Congress and the general public, must recognize that *total system cost* must go beyond mere acquisition cost and include the cost of ownership until the last operational unit is retired from service. This says that a price tag attached to a stated requirement should always include the total cost of ownership. When this occurs, we will be in a position to make meaningful tradeoffs between development, investment and operational saving, as well as between the desired performance parameters themselves.

This, I believe, brings us to a definition, broad as it may be, of product trends for the 1970s. We will no longer try to meet our increasing needs primarily by designing and fielding weapon systems which are increasingly complex and expensive; rather, we will prudently apply our creativity and technological skills in the direction of more system simplification. I am sure there are many who have the impression that it is easy to design a simple system, and most difficult to design a complex one. This might be true if the simple system reflects simple requirements, but a real challenge and real agony lie in translating a complex set of requirements into a simple system—a low-cost system—one which also embodies functional and operational excellence—one which is characterized by high reliability—one which is easy and inexpensive to maintain and to support—and one which can be efficiently and effectively used in its operating environment.

This is the only way we can afford what we need. It's just simply the way it's got to be.

The problem now is how to accomplish these seemingly impossible objectives. Possibly one of the best ways is to insist, particularly in the early stages, on a larger portion of our effort and time in recycling or refining the design to reduce cost and complexity. Expensive solutions are generally the result of first-time-around ideas. Simplified designs, with reduced costs, usually are the result of iterative design simplification efforts.

This brings me to my second broad subject. The composition and scope of today's engineering and scientific community has changed drastically in the last decade or two. The graduating engineer of today has many more fields of specialization in which to pursue his career. The active professional engineer or scientist is under constant pressure to continue his education in parallel with his work, and greater specialization is usually the result.

While this trend is appropriate and necessary to serve many needs of our country, I feel that the challenge and fascination of the field of general engineering or, more specifically of system design, has too often been overlooked. Perhaps this intense specialization has become the norm just when we can least afford it in defense work—just when system complexity seems to be an unfortunate rule rather than a special exception, when system design seems to be driven by the available technology rather than the true need, and decisions are slowed by mountainous documentation.

I believe the difficulty of achieving a simple, cost-effective, functionally excellent product is increased by the seeming disappearance of the "total system designer." For example, it would be difficult to identify clear successors to the Kindelbergers, the Johnsons, the Heinemanns, or the Messerschmitts in today's engineering community. These people, total system designers in every sense of the word, may not have successors, even though we will need them desperately in the 1970s. These are the people who think from the beginning of the operational environment. These are the people who think from the beginning of logistic problems. These are the people who are concerned from the beginning with simplicity, cost, reliability, and all of the interlocking factors which decide whether a system will be good or bad.

So perhaps one of our problems is not only "to revamp our design philosophy," but to recreate a place in the sun for experienced, yet up-to-date people who will make reasoned judgments on total system design. We need creativity and imagination, vision and foresight, dedication and self-discipline. In the process of translating stated operational requirements into usable hardware, the decisions must benefit, not plague, the operating community.

Today, there appears to be too much tendency to pull together a team of specialists—the best technical experts in materials, in structures, in engines, avionics, data handling, etc. This is easy to do and it is often wrong. It can lead to the development of an over-designed machine—one that is so complex that it can be made to work in the factory but not in the field. It will be a system that requires mountains of paper to describe, thousands of highly trained people to operate and maintain, and will not really suit our needs.

What we need are teams led by professionals in the broad art of basic design of military systems—men who know the strategy, the tactics, the nature of the weapons we have and those we will oppose, men who know the user's environment. Once these factors have been considered to scope the design, these broad-gauge leaders can then properly phase in the efforts of the specialists in each specific area, as they are needed.

To sum up my second point, it seems that we have the monumental task of changing both the *people* and the *environment* in order to achieve our product objectives for the 1970s.

As my third point, I submit that there are two broad areas in which logistic system people must be effective and that, if these areas are not distinctly clear in the minds of the logisticians, we will continue to address inadequately the fundamental design problem. We will continue to overkill with detail planning and overlook basic problem solving.

The formulation of a good logistic support system can be likened to the creation and development of a good engineering design. The system design process breaks down into two basic phases: first, the conceptual phase, including validation; and second, the full scale development phase—the "pick and shovel" phase. In system design, if we attempt prematurely to define detailed hardware, we begin to

lose sight of the major parameters which we are struggling to achieve. For example, if we become engrossed in configuration end-item specifications before a solid configuration has emerged, the fundamental system objectives get lost in detail. I see the same thing happening in the logistic support system profession. The eagerness to define the system in detail has smothered and circumvented the conceptual creativity during the earlier stages, and has defeated the basic purpose of the entire logistic effort.

So I suggest that the first part of the logistics problem is to fix basic product characteristics that will make the system sensible from an operational point of view. The second part is to produce the detail planning, supporting procedures, and policies *after the original configuration has been set.*

This, to me, is the heart of Deputy Secretary of Defense Packard's two references to the logistic support problem in his important memorandum of May 28. I quote the first:

> "Consideration must be given *in development* to all matters necessary in a full operating system. This will include such things as maintenance, logistic support, training, etc."

I now quote the second:

> ". . . where these matters are dependent upon the final production design, *as much of this work as possible should be delayed until the production stage.*"

If these two different task areas can be understood and defined, I feel that the necessary interchange and joint sense of purpose between the engineering design community and the logistics system community can be developed and strengthened.

Engineers must be motivated to consider the operating environment in the same manner as they consider system weight, structural integrity, reliability and system cost. They must realize that the system they produce cannot be evaluated as a good system if, from the logistics point of view, it is too difficult or costly to support. I believe it is extremely important at the outset to set limits on what is considered too difficult, too costly, and to set minimum acceptable characteristics.

Logistics people must likewise be motivated to state their conceptual objectives in a manner and form meaningful to the engineer. When a designer is given a job to do, one of the first things he wants to know is how much time he has. Everything he does from then on may be constrained by time. He is further constrained by many other requirements, some which are adequately defined and often quantified, and others which are loosely described and hazy. The attention which he pays to his constraints is greatly influenced by the degree to which they are clear.

Weight, for example, is a relatively easy problem to address because it lends itself to clear understanding. Where system weight is a requirement, each designer begins his work with his own weight objective clearly in mind, regardless of level of detail. To a lesser degree he has some idea of the requirements for reliability. He knows what the system must do in terms of performance but, when it comes to the operating environment, he may have a hazy idea of what is needed. This then gives the designer a poor basis for performing the vital tradeoffs that must be made with other major system needs.

Logisticians will substantially advance their own cause and actually assist the beleaguered designer by making sure that logistic considerations, introduced in the early conceptual stage, are confined to those which directly contribute to the physical characteristics of the system hardware. By this I mean that the system design people should not be asked during the early development process to attempt a quantification or a detailed definition of spares requirements, of manning requirements that are not a system parameter, of maintenance levels, or of the personnel training problem. Very simply, we must allow the designer time to gather his thoughts and to put his best conceptual effort into the physical configuration of the system itself. This effort, therefore, must be constrained only by those parameters which are truly necessary as inputs to the basic system itself. It's the age-old, horse-sense story of doing first things first.

The best solution to this is to have designers who understand the implications of excessive spares, maintenance, or personnel training so that it is an inherent part of their initial thinking.

Earlier I mentioned the efforts of specialists in the system design. You know that as problems were recognized in such areas as reliability, maintainability, logistics support, safety, etc., the functional managers in DOD rightfully gave special emphasis to these areas. This, in turn, has resulted in the growth of specialist groups in both Government and industry in these areas. New contract requirements have been established but, while not mutually exclusive with respect to one another, the technical efforts to satisfy these requirements are often managed separately and not as a part of the mainstream of engineering. There has been a natural tendency for each of these supporting activities to become an end unto itself, *i.e.*, more and more we seem to get reliability for reliability's sake, etc. We often find that, in effect, the specialists themselves decide on the project effort in that area. This produces a built-in bias *for* complexity and *against* simplification. It is essential that your group recognize this aspect of the problem and the need for appropriate tailoring and timing of logistics efforts in the total system development effort.

Now, there is another reason for the sensible phasing of detailed and exhaustive planning *of any kind.* During the conceptual phase, prior to full-scale engineering development, we are normally in a competitive situation where at least two or three contractors are simultaneously expending research, development, test and evaluation (RDT&E) funds. Premature activity of *any* kind, therefore, may not only necessitate a 50-percent re-do on the part of the winning contractor but the costs associated with premature activity will be multiplied by the number of contractors who are actively engaged in the competition.

By simple arithmetic, if three competitors were accomplishing premature work, and the winning contractor's efforts were only 50-percent usable at a later date, we would reap one-sixth of the total work performed and paid for. I ask you: How mean-

ingful is the detailed logistics plan for the paper avionics for a paper airplane?

Furthermore, because there are a number of people who take the results of premature work seriously, there is often substantial effort and cost to *undo* this work before the *re-do* can start. Is it necessary to add that *we cannot afford this?*

Let me now articulate my first challenge to you. Take a long, hard look at your total mission task. Decide very selectively what comprises the absolute minimum to be accomplished prior to full-scale engineering development and then prior to final production design. Don't feel you're alone in this matter; we in engineering are faced with doing exactly the same thing.

After you have accomplished this painful task, after you have defined that necessary minimum to be accomplished during the conceptual phase, you should then focus your attention and effort upon upgrading logistics design parameters to a degree commensurate with their importance. Herein lies my second challenge. Logistics system requirements must be clearly stated, and where possible quantified, in a "design to" fashion, lest we continue to experience deficiency and unnecessary compromise in supporting and maintaining the operational system.

I hasten to add that it is here that the system design and logistic support people must function together. If there is a single key to the solution of our total problem, it almost has to be the one I have just mentioned: a single-minded, problem-oriented, joint approach by engineers and logistics systems people. I believe we can help with your problem. I know you can help us with ours.

In summary, I would like to restate and emphasize the two challenges that I made earlier: first, that you clearly and distinctly define the two phases of your work, that which must be done *during* the conceptual, and that which can be done *afterwards;* and, second, that you formulate the kind of definition of requirements which the designer can use to influence the hardware.

From my point of view, the design community at large must be convinced that no design is complete and that no system is adequate unless it is operationally effective and unless it is supportable in its ultimate environment. This turns my challenges into a *we* rather than a *you* effort.

I hope and trust that these thoughts will help to keynote this conference and possibly influence the thinking and discussion which will follow.

I have tried to pose challenges to each of you. For my part, I accept the challenge posed to DOD management—to acquire effective weapons at reduced costs. In fact, we share the same challenges.

Logistics—Challenge of the 1970s

Excerpts from an address by Hon. Barry J. Shillito, Assistant Secretary of Defense (Installations and Logistics), at the First Annual Summer Meeting of the Logistics Management Advisory Committee, National Security Industrial Association, Absecon, N.J., June 29th, 1970.

Obviously, at this session, I can't cover all the programs or actions underway or planned by us in logistics to participate in the acquisition process for new products and provide the follow-on support during operational use. But, there are three areas I will discuss, all involved in helping us to live within the defense budget of which maintenance is such a major part—contracting for new products, acquiring planned engineered logistic support for these products, and managing the logistic support. I would also like to kaleidoscopically touch briefly on a number of other present and future efforts.

It is not uncommon knowledge that the defense budget is the most tightly controlled and closely scrutinized of all the major elements of the Federal budget. The Office of the Secretary of Defense, the Bureau of the Budget, and four Committees of Congress are involved in this budget, item by item. Many other committees spend a major portion of their time on matters relating to defense. There are some persons who have argued that our military budget is out of control. I think the facts clearly demonstrate that it is under the severest kind of controls. The Expenditure Authorization for FY 1971 of $71.8 billion reflects the determination of the new management team under Secretary of Defense Laird to pare down the costs of defense wherever and whenever possible, without impairing our capacity to provide for the national security.

Today's budget reductions did not just happen. They resulted from detailed study and analysis of how DOD management systems were built and used, and especially focus on management improvement.

Hon. Barry J. Shillito

The veritable explosion in technology we have experienced in the past will not slow down, but it will be accelerated. Much as we would like to think otherwise, our systems of the 1970s will probably be more sophisticated, more complex, have higher performance levels and be more costly. We must continuously give attention to ensuring that such systems are as simple and as economical as possible while meeting our requirements.

Changes in both the completion of programs and the funding of them will occur as a result of Congressional actions. How to manage these changes will be one of the most important challenges of the decade.

The outside demands of greater visibility as to how we manage will probably increase. These demands will come from the Congress, the General Accounting Office, and from the public and news media. Our credibility will continue to be at issue. The amount of support we get for defense programs will be a direct result of our performance.

To address that portion of contracting for new products which pertains to maintenance, let me refer to the consideration currently being given to the old concept of life-cycle costing. With selected items, the military services are including in their evaluation of a product the initial cost, the life span of the article, and the maintenance costs expected. Articles selected are those where the mean time between failure, the mean time between repair and repair cost (*i.e.*, labor, materials, equipment and facilities) could be reasonably computed. Maintenance, as you know, will play a greater role in determining which item is procured to a greater degree in the future as we better learn how and when to use this technique. It has taken a long time to get this life-cycle cost effort off dead center and I believe it is finally starting to work.

* * * * *

How are we going to get the engineered logistic support for new systems and equipments we must have? We are going to get it the only way we can—through the engineering process, more specifically in the design phase.

Since the Integrated Logistic Support (ILS) directive was issued in 1964, you have heard a lot about the subject and have witnessed ILS growth both in the DOD and industry. However, even today there is not complete acceptance and application of ILS. Comments have been made to the effect that "We have always considered logistic support. Why do we need ILS?" This statement can be refuted when you look at some of the case histories of support problems traceable back to lack of adequate planning in the early acquisition phases.

There have been other statements that ILS has not been specified sufficiently well in RFPs or has been specified in such terms as to result in a corresponding paper effort worth little to either the customer or the contractor. Reviews of RFPs have confirmed these remarks to be true in some cases; however, these evaluations have also revealed excellent examples of these RFPs that did delineate the ILS goals in meaningful terms leading to effective ILS programs.

There is no argument that ILS has a way to go before it reaches the level of logical, sound application. I am the first to admit this. But progress is being made. We do not have to provide the logistician with better tools to do the job, but more importantly, the logistician must establish a rapport and dialogue with the designer and furnish him the logistic support requirements in quantitative terms: something he can understand and design to. Better still, the logistician should be working with the designer to "design out" support needs at every opportunity. We are working with research and engineering people to develop the exchanges and methods necessary to ensure that ILS is phased into the engineering process at the appropriate time and that ILS management takes an active role in design and design reviews. We, of course, must be watchful to ensure that ILS upstream efforts are always worth the cost of such efforts.

Through the DOD-Industry ILS Advisory Committee, chaired by Paul Riley [Deputy Assistant Secretary of Defense (Supply, Maintenance and Services)], industry representatives are helping us in DOD to improve ways to implement ILS and place it in the proper perspective. The Director, Defense Research and Engineering plays a very active role on this committee. . . .This output oriented committee has an aggressive program, and I am very pleased with its progress to date. . . .

But before leaving this subject, I want it known that both Dr. John S. Foster Jr. and I back the ILS concept fully and intend to provide the emphasis needed, and the resources required, to make it work effectively.

We spend approximately $18 billion of our budget on maintenance and, of this, $6 billion, or one-third, can be attributed directly to depot maintenance alone. Considering the hundreds of contractor facilities along with approximately 100 government depot maintenance facilities, it becomes apparent that the management of maintenance in the depot area alone constitutes a substantial portion of the logistic support management problem.

In consideration of the management of the support of weapons and equipments acquired, we have recently revised our policy guidance on the use of contractor and government resources for the maintenance of materiel. This was covered through a re-issuance of DOD Directive 4151.1. Essentially, this re-issuance incorporates changes that will provide for clearer definitions of policy, and it establishes quantitative parameters for use in decision making associated with the distribution of maintenance workloads among contract, organic and interservice sources. The objective is to provide for that distribution which will produce the greatest return for the least cost.

We recently established a Joint Logistics Policy Committee composed of representatives from the Office of the Secretary of Defense, the Joint Chiefs of Staff, Defense Supply Agency, and the four military services, including the Marine Corps. This committee is devoted to defining and isolating problems common to all the military services, then assigning to one of the members the task of solving a particular problem with members of each of the other services assisting. This group is available to assist in improving our joint maintenance efforts with participation by all concerned.

This group has been or presently is concerned with:

- Development of a description of the emergency logistics systems profile for the 1975–1980 time period.
- Comparison of the individual military services and DOD concept of subsistence systems.
- Production of a standard method for documenting the individual military service logistics systems to permit comparison and evaluation.
- Evaluation of telecommunications capabilities for support of the logistics systems now and in the environment of the 1970s.

The $12 billion consumed on maintenance below the depot level is being monitored by The Army Equipment

Record System (TAERS), the Navy Maintenance and Material Management (3–M), the Marine Corps Unified Material Management System (MUMMS), and the Air Force Manual 66–1. These systems are becoming more refined. The data produced, along with the Comptroller's "below depot cost accounting system," should produce the data to allow us to significantly evaluate this area for better utilization and cost effectiveness.

I feel that we are on the road to improved readiness of our weapon systems and equipment by more effective maintenance and reduced costs, but our goals for the 1970s in this area are almost the same as those I outlined last year:

- A more disciplined approach to management on a total cost basis by weapon system.
- Cost consciousness by management at each level of command in the evaluation of alternatives and support decisions.
- Improved planning and programming of maintenance requirements.
- Greater precision in estimating and pricing maintenance requirements.
- Increased participation in the budget and apportionment process.
- Intensified review and analysis of planned and actual program performance.
- Improved data base for life-cycle costing.
- More timely initiation of corrective measures.
- More emphasis on equipment support demand and technical criteria in order to influence reliability and maintainability of both current and future systems.

Ballute Tested

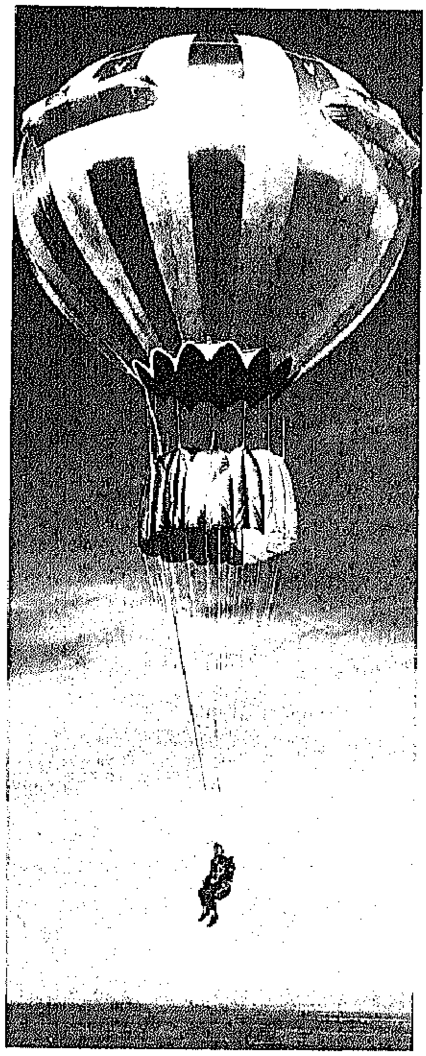
Phase II testing of the Pilot Airborne Recovery Device (PARD), a discretionary descent system using a hot air balloon to rescue pilots downed in combat, has been successfully completed by the Air Force Systems Command's Aeronautical Systems Division (ASD).

Tests included 10 drops and mid-air recoveries of anthropometric dummies at El Centro, Calif., and jet car ejections at speeds of 50 and 250 knots at the Naval test facilities in Philadelphia, Pa., and Lakehurst, N.J.

After a pilot ejects, his main parachute opens normally. The pilot may, at his discretion, use the PARD, which is a balloon that inflates as air rushes through a hole in the top of the pilot's main parachute. A burner, fed from a butane gas tank strapped to the pilot's back, heats the air flowing into the ballute (balloon-parachute) to 250 degrees Fahrenheit. This provides sufficient lift to halt his descent and allows him to hover out of range of enemy small arms fire. The ballute is pre-set to carry a disabled pilot to 6,000 feet. It can be manually operated to reach an altitude as high as 10,000 feet.

The ballute will keep the pilot aloft for 30 minutes, giving rescue aircraft time to locate him. The rescue aircraft then snatches the flyer in mid-air, and either reels him in or tows him to friendly territory, where he can be released to descend by his main parachute.

Additional drop and sled testing to evaluate reliability has been proposed. The system will also be tested in F–4 aircraft if funds are approved.



Colonel Albert P. Lovelady is the Director of ASD's Life Support Systems Program Office at Wright-Patterson AFB, Ohio.

High Altitude Jet Engine Icing Can Be Simulated

Modifications to a high-altitude simulation test cell have made possible tests of large turbofan and turbojet engines under icing conditions.

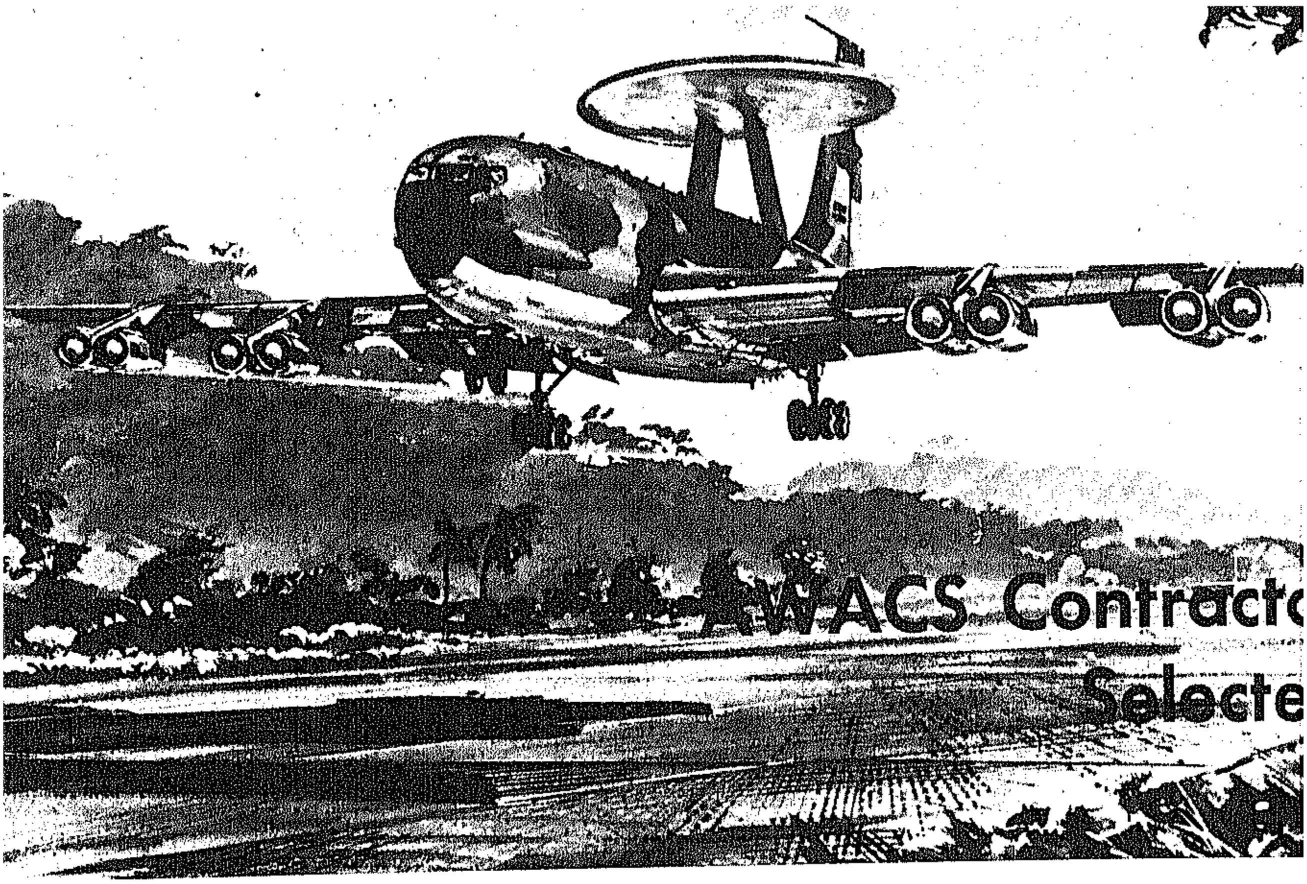
Previously, large engine icing tests were conducted by flying the engine through natural icing conditions or through a cloud formed by water released from a tanker aircraft. Test conditions were difficult to duplicate. Tests may now be conducted at any desired altitude and Mach number. Water droplet size and concentration can be controlled to produce icing of any desired nature.

A holographic system, consisting of a pulsed ruby laser on one side of the cell and a photographic plate on the other measures the size and number of water droplets in the air flow. Accurate determination of inlet icing conditions is possible. Conditions can be regulated to match test specifications.

The cell is at the Air Force System Command's Arnold Engineering Development Center, Arnold AFS, Tenn.

DSA Has M-Day Openings

Defense Supply Agency has mobilization positions for reserve majors, lieutenant colonels, lieutenant commanders and commanders at many activities. Further information may be obtained by writing to Director, Defense Supply Agency, (Attention DSAHMR), Cameron Station, Alexandria, Va. 22314, or by phoning (202) 694–6081.



AWACS Contracto
Selecte

The Air Force has selected The Boeing Co., Seattle, Wash., as the prime contractor to begin development of the Airborne Warning and Control System (AWACS).

The $169,982,522 cost-plus-incentive contract is for phase one of the AWACS program: development and flight testing of two competitive radars and radomes. Initially, $16.5 million of approved funds were obligated.

The present contract constitutes approval for phase one only. Progression to later phases will be subject to Congressional approval, and will depend on successful demonstrations by Boeing at specified milestones in the program, and on future Defense Department and Air Force decisions.

Phase two of the AWACS program includes full scale development and integration of the total radar and aircraft system; phase three is aircraft production. Phase two, if undertaken, would be under a cost-plus-incentive contract; phase three would be fixed-price-incentive.

Total cost for all three phases of the AWACS program is estimated to be approximately $2 billion. The Boeing Co. is in full compliance with equal employment opportunity requirements of the law.

Phase one includes modification of a 707-type aircraft to carry the AWACS equipment and a crew of 17. Equipment consists of an airborne surveillance radar, beacon tracking, navigation, communications, data processing identification, presentation/display and software systems.

Changes to the 707 airframe include structural strengthening to accommodate the increased weight of the avionics, and the radar antenna rotodome. An elliptical disc 30 feet in diameter, the rotodome will be supported on pylons 10 feet above the fuselage.

Operational capabilities include sustained flight at high speeds, and a minimum on-station time of seven hours, which can be increased by in-flight refueling.

Two competitive surveillance radars, one developed by Hughes Aircraft Co., and the other by Westinghouse Electric Co., will be flight tested. At the end of phase one radar will be eliminated, and the will be integrated with addi AWACS equipment to demon overall system performance.

AWACS is being developed to two defense requirements: ai fense, and tactical command an trol. Current continental U States air defenses were design the 1950s to counter high altitud sonic, or slightly supersonic, bon Today's threat is composed of of ballistic missiles and bon While the primary threat is th sile, the threat of bombers ha diminished. Present Soviet bombers are capable of low-level tration, and are also capab launching stand-off air-to-surfac siles. Air defenses presently hav imal capability against these due to limited low altitude ov radar coverage and limited det range of ground-based radars. tionally, present ground-based a fense systems are vulnerable t sile attack.

AWACS, according to th

Force, will be a key element in the bomber defense modernization program, which also includes Over-the-Horizon Backscatter radar and improved interceptors. The AWACS force should give a survivable wartime command and control system.

In addition, AWACS will extend low level radar coverage and surveillance, and with it, the capability to extend the bomber engagement area well beyond U. S. borders. According to the Air Force, AWACS would also be more effective against some of the current Soviet tactics than present systems. The probability of intercepting and destroying bombers armed with stand-off air-to-surface missiles will be much greater than with present systems.

Finally, AWACS would be less vulnerable to defense suppression in a combined missile/bomber attack because it would not depend on fixed command and control centers such as SAGE (Semiautomatic Ground Environment) and BUIC (Backup Intercept Control). The Air Force estimates AWACS will be much less expensive over its lifetime than the alternative of continued reliance on the SAGE and BUIC systems.

In the tactical air control role, AWACS will provide quick reaction command and control for deployment to any area. Once there, AWACS will provide surveillance and control necessary for air superiority and direct air support of ground forces.

Specific command abilities include:

- Direct command of the offensive battle.
- Direct communication with strike forces.
- Real time display of the disposition of friendly and enemy forces.
- Overland radar capability for detecting enemy forces, and directing friendly forces into combat position.
- Relay of communication transmissions.
- Interrogation of friendly forces by beacon.

Responsibility for overall systems development of AWACS belongs to the Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. Colonel Kendall Russell is the AWACS program director.

Meetings and Symposia

SEPTEMBER

Laser in Science and Technology Symposium, Sept. 15–16, at the University of Washington, Seattle, Wash. Co-sponsors: Air Force Office of Scientific Research and the University of Washington. Contact: Milton Rogers, Air Force Office of Scientific Research (SREM), 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) OXford 4-5567.

OCTOBER

Fourteenth Annual Organic Chemistry Conference, Oct. 8–9, at Natick, Mass. Sponsor: Chief of Research and Development, Dept. of the Army. Contact: Dr. Louis Long Jr., Head, Organic Chemistry Group, PRL, Army Natick Laboratories, Natick, Mass. 01760. Phone (617) 653–1000 Ext. 2414.

Solid Mechanics 1970—Lightweight Structures Symposium, Oct. 13–14, at the Army Materials and Mechanics Research Center, Watertown, Mass. Sponsor: Army Materials and Mechanics Research Center, Watertown, Mass. Contact: Joseph I. Bluhm, Chief, Theoretical/Applied Mechanics Research Laboratory, Army Materials and Mechanics Research Center, Watertown, Mass. 02172.

Sixteenth Design of Experiments in Army Research, Development and Testing Conference, Oct. 21–23, at the Army Logistics Management Center, Fort Lee, Va. Sponsor: Army Research Office—Durham. Contact: Dr. Francis G. Dressel, Mathematics Division, Army Research Office—Durham, Box CM, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285 Ext. 75.

Special International Engineering Geologists Symposium, Oct. 22–23, at the Mayflower Hotel, Washington, D.C. Sponsor: Army Research Office—Durham. Contact: Dr. William Van Royen, Dir., Division of Environmental Sciences, Army Research Office—Durham, Duke Station, Durham, N.C. 27706. Phone (919) 286–2285 Ext. 52.

Biodynamic Models and Their Applications, Oct. 26–28, at Dayton, Ohio. Co-sponsors: Aerospace Medical Research Laboratory and the National Research Council, National Academy of Sciences. Contact: 6570 Aerospace Medical Research Laboratory (MRB), Wright-Patterson AFB, Ohio 45433. Phone (513) 255–3602.

Approximation Theory and Related Topics and Their Applications, Oct. 26–30, at the University of Maryland, College Park, Md. Sponsor: Air Force Office of Scientific Research. Contact: Major Phillip Callas, Air Force Office of Scientific Research (SRMM), 1400 Wilson Blvd., Arlington, Va. 22209. Phone (202) 694–5262.

First Western Space Congress, Oct. 27–29, at Santa Maria, Calif. Sponsor: Vandenberg Scientific and Technical Societies Council. Contact: B. Z. Woods, Exhibits Chairman, P.O. Box 1134, Santa Maria, Calif. 93454.

NOVEMBER

Twelfth Liquid Propulsion Meeting, Nov. 17–19, at the Stardust Hotel, Las Vegas, Nev. Sponsor: Joint Army, Navy, Air Force, and National Aeronautics and Space Administration Interagency Propulsion Committee. Contact: T. M. Gilland, Chemical Propulsion Information Agency, Johns Hopkins University, Applied Physics Laboratory, 8621 Georgia Ave., Silver Spring, Md. 20910. Phone (301) 589–7700.

Security Seminar Set for Mid-September

The Sixteenth Annual American Society for Industrial Security Seminar will be held September 15–17 at the Sheraton Boston Hotel, Boston, Mass.

Keynoting the session on Defense Department security will be Joseph J. Liebling, Deputy Assistant Secretary of Defense for Security Policy.

For further information and registration forms for the seminar, contact William D. Wright Jr., American Society for Industrial Security, 2000 K Street NW, Room 404, Washington, D.C. 20006, phone (202) 338–7676.

RESEARCH REPORTS

Organizations registered for service may obtain microfiche copies of these documents without charge from:
Defense Documentation Center
Cameron Station
Alexandria, Va. 22314

All organizations may purchase microfiche copies (65¢) or full-size copies ($3) of the documents (unless otherwise indicated) from:
Clearinghouse for Federal Scientific and Technical Information
Department of Commerce
Springfield, Va. 22151

All orders to the Clearinghouse must be prepaid.

Adhesion Bonding. Defense Documentation Center, Alexandria, Va., April 1970, 140 p. AD-704 525.

Solar Cells and Solar Panels. Defense Documentation Center, Alexandria, Va., Jan. 1970, 111 p. AD-700 500.

Space Electrical Power Systems for the Mid-1970s. R. V. Silverman, Navy Space Systems Activity, Los Angeles, Calif., Sept. 1969, 122 p. AD-701 352.

Literature Search: Injection Molding Processing Parameters. N. T. Baldanza, Plastics Evaluation Center, Picatinny Arsenal, Dover, N.J., July 1969, 36 p. AD-703 530.

Xenon Lamps. Defense Documentation Center, Alexandria, Va., March 1970, 102 p. AD-702 725.

Why Not Go Numerical Control. L. L. Dauber, Edgewood Arsenal, Md., Sept. 1969, 15 p. AD-695 611.

Nuclear Magnetic Resonance. Defense Documentation Center, Alexandria, Va., March 1970, 342 p. AD-703 400.

Summary Report on Project Tektite I. D. C. Pauli and H. A. Cole (editors), Office of Naval Research, Washington, D.C., Jan. 1970, 59 p. AD-702 060.

Packaging and Shipping of Radioactive Materials: Symposium Summary. L. K. Aldric (editor), Army Engineer Reactors Group, Fort Belvoir, Va., March 1969, 141 p. AD-701 063.

Vibration Testing of Resilient Package Cushioning Material: Polyethylene Foam. G. Zell, Picatinny Arsenal, Dover, N.J., Dec. 1969, 98 p. AD-701 006.

Faraday Rotation. Defense Documentation Center, Alexandria, Va., Feb. 1970, 106 p. AD-700 600.

The Mathematics of Signal Recovery. D. L. Chaffee and R. D. Benning, Naval Civil Engineering Laboratory, Port Hueneme, Calif., Dec. 1969, 61 p. AD-700 244.

Packaging (Ordnance). Defense Documentation Center, Alexandria, Va., Jan. 1970, 62 p. AD-701 700.

Fluerics 28: State of the Art 1969. J. M. Kirshner and R. Gottron, Harry Diamond Laboratories, Washington, D.C., Dec. 1969, 38 p. AD-703 117.

GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from:
Superintendent of Documents
U.S. Government Printing Office,
Washington, D.C. 20402

Selling to Navy Prime Contractors. Provides guidance and information for business concerns seeking subcontracting opportunities with Navy prime contractors. Includes a directory of prime contractors, contacts within the company and items produced by the company. 1969. 98 p. D201.2: Se4/2/970. $1.00.

Defense Supply Procurement Regulation, Revision No. 1, Dec. 5, 1969. Revision No. 1 to the 1969 edition of the Defense Supply Procurement Regulation. 1969. 29 p. D7.6/5: 969/rev. 1. 30¢

MILSTRIP, Military Standard Requisitioning and Issue Procedures, Change 24, December 1969. 1970. 32 p. D7.6/4:M 59/ch. 24. 25¢.

Changes to MILSTRIP Military Assistance Program Address Directory, Supplement No. 2, October 1969. Change No. 4, February 1, 1970. 44 p. D7.6/4:M 59/supp. 2/rev.-3/ch. 4. 45¢. Change No. 5, March 1, 1970. 36 p. D7.6/4:M 59/supp. 2/rev.-3/ch. 5. 35¢.

DEFENSE PROCUREMENT CIRCULARS

Distribution of Defense Procurement Circulars is made automatically by the U.S. Government Printing Office to subscribers of the Armed Services Procurement Regulation (ASPR).

Defense Procurement Circular No. 78, May 13, 1970. (1) Contracting With Small Business and Labor Surplus Area Concerns/Defense Manpower Policy No. 4 (A) Memorandum from the Assistant Secretary of Defense (Installations and Logistics). (B) Small Business and Labor Surplus Area Concerns. (2) ASPR Manuals and Supplements. (3) Postponement of Use of Defense Organizational Entity Standards (DOES) Code. (4) Transportation, Consignment and Marking Instructions. (5) Status Report of Defense Procurement Circulars.

[Editor's Note: Item 5 of DPC 78 rescinds DPCs 60 through 64, and 67, due to expiration or incorporation into the 1969 edition of the Armed Services Procurement Regulation. DPCs 1 through 59 were rescinded Jan. 2, 1969.

Item 5 also lists those portions of DPCs 65 and 66, and 68 through 77, remaining in effect until incorporated into the ASPR or until specifically canceled.]

Defense Procurement Circular No. 79, May 15, 1970. (1) Cost Principles—Application of Section XV to Fixed Price Contracts.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Brig. Gen. (selectee) William T. Meredith, USAF, is now Dir., Real Property Maintenance, Office of the Asst. Secretary of Defense (Installations and Logistics).

Brig. Gen. James D. Kemp, USAF, is the new Commander, Defense General Supply Center, Defense Supply Agency, Richmond, Va.

J. Edward Timmins Jr. has been named Comptroller, Defense Communications Agency, Arlington, Va.

DEPARTMENT OF THE ARMY

Maj. Gen. Leo B. Jones is the new Asst. Dep. Chief of Staff for Logistics, Office of the Chief of Staff of the Army. Also in the Office of the Chief of Staff, **Brig. Gen. Darrie H. Richards** has been designated Dep. Chief of Staff for Logistics (Supply and Maintenance).

Maj. Gen. William C. Gribble has been named Dep. Chief of Research and Development.

In the Military Traffic Management and Terminal Service, **Brig. Gen. Otis E. Winn**, USAF, has been appointed Dep. Commander, and **Capt. Jack Bishoff**, USN, has been named Asst. Commander.

Brig. Gen. (selectee) George A. Rehb will be the Dep. Dir. of Military Construction, Office of the Chief of Engineers, Washington, D.C.

Brig. Gen. (selectee) Richard W. Swenson is now Commander, Army Communications Systems Agency, Army Materiel Command, Fort Monmouth, N.J.

Brig. Gen. (selectee) Arthur S. Hyman is now Commander, Institute of Land Combat, Combat Development Command, Fort Belvoir, Va.

Col. Robert J. Bennett has been appointed Chief of Staff, Safeguard System Command, Hq., Army Missile Command, Huntsville, Ala.

Col. Frank P. Clark is the new Commander, Rock Island Arsenal, Ill.

Col. David William Einsel Jr. has assumed command of the Harry Diamond Laboratories, Washington, D.C.

Col. Henry F. Grimm Jr. was assigned recently as Dep. Chief of Staff for Test and Evaluation, Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

Col. William J. Lynch is Commander, Army Research Office, Durham, N.C. He has been succeeded in his former position as Asst. Dir. of Army Research and Commander, Army Research Office, by **Col. Norman R. Rosen**.

Dr. George E. Schafer is the new Chief Scientist and Technical Dir. of the Army Electronic Proving Ground, Fort Huachuca, Ariz.

Lt. Col. Harvey L. Arnold has been designated Dir., Army Engineer Reactor Group, Fort Belvoir, Va.; Chief, Nuclear Power Div., Office of the Chief of Engineers; and Asst. Dir., Div. of Reactor Development and Technology, U.S. Atomic Energy Commission.

Lt. Col. John A. Callanan has been named Dir., Nuclear, Biological, and Chemical Material Testing, Hq., Army Test and Evaluation Command, Aberdeen, Md.

Lt. Col. Ernest D. Peixotto is now Dir., Army Engineer Waterways Experiment Station, Vicksburg, Miss.

DEPARTMENT OF THE NAVY

Adm. (selectee) Ralph W. Cousins has been designated Vice Chief of Naval Operations.

Other new appointees in the Office of Chief of Naval Operations include: **Vice Adm. Benedict J. Semmes**, Dep. Chief of Naval Operations (Fleet Operations and Readiness); **Vice Adm. (selectee) Ralph Weymouth**, Dir., Navy Program Planning; **Rear Adm. Kent L. Lee**, Dir., Office of Program Appraisal; and **Rear Adm. William H. Livingston**, Dir., Air Surface and Electronic Warfare.

Rear Adm. William J. Moran has been named Commander, Naval Weapons Center, China Lake, Calif.

Capt. Henry E. Davies Jr. has been designated Commander, Naval Ordnance Missile Test Facility, White Sands Missile Range, N.M.

Capt. Robert F. Reilly is now the Commander, Atlantic Area, Military Sealift Command, Brooklyn, N.Y.

DEPARTMENT OF THE AIR FORCE

Maj. Gen. James M. Keck is the new Dep. Dir. of Operations, Office of Dep. Chief of Staff, Plans and Operations, Hq., USAF, replacing **Maj. Gen. Joseph J. Kruzel** who retired.

Brig. Gen. Robert E. Hails, Dep. Chief of Staff for Maintenance, Air Force Logistics Command, Wright-Patterson, AFB, Ohio, has been promoted to the rank of major general.

Brig. Gen. Walter R. Hedrick Jr., Dir. of Space, Dep. Chief of Staff for Research and Development, has retired.

Col. Robert F. Trimble is the new Dir., Procurement Policy, Office of Dep. Chief of Staff, Supply and Logistics, Hq., USAF. He replaces **Brig. Gen. James O. Lindberg** who retired.

New assignments in the Air Force Systems Command include: **Col. William C. Schwitzgebel**, Asst. Dep. for Space Communications, Space and Missile Systems Organization, Los Angeles, Calif.; **Col. Robert H. Spencer**, System Program Dir., Over the Horizon System Program Office, Electronics Systems Div., Hanscom Field, Mass.; **Col. Robert P. Daly**, Dep. for Engineering, Aeronautical Systems Div., Wright-Patterson AFB, Ohio; and **Col. Algernon G. Swan**, Commander, Air Force Special Weapons Center, Kirtland AFB, N.M.

Col. John D. Peters, Dir., Civil Engineering, Air Force Systems Command, Andrews AFB, Washington, D.C., has been promoted to the rank of brigadier general.

In July 1969, President Richard M. Nixon appointed a Blue Ribbon Panel to study and report on the organization and management of the Defense Department. The panel reported its findings and recommendations to the President and Secretary of Defense on July 1, 1970.

The Defense Industry Bulletin staff has excerpted and condensed portions of the report thought to be of most interest to industry readers. The executive summary, printed in full, indicates the broad coverage of the full report.

Publication of these excerpts does not imply that the panel's findings and recommendations are established DOD policy.

The entire Report to The President and the Secretary of Defense on the Department of Defense by the Blue Ribbon Defense Panel, July 1, 1970, is available by mail from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; price, $2.25; order number D 1.2/B62/970. At press time, the publication was also available at the Government Printing Office's main and Pentagon book stores.

Appendices to the report on the following subject areas to be published separately are:

- Mechanisms for Change—Organizational History.
- Missions and Functions, Washington Headquarters Staff.
- Functional Analysis—Washington Headquarters Staffs.
- Personnel Data and Trends in Staff Sizes.
- Major Weapon Systems Acquisition Process.
- Operational Test and Evaluation.
- Supply, Maintenance and Transportation.
- Telecommunications.
- Automatic Data Processing.
- Audit Procedures.
- Conflicts of Interest.
- Comparisons of DOD, NASA and AEC Acquisition Processes.
- Correspondence Control and Mail Distribution in Washington Headquarters.
- Joint Chiefs of Staff Decision Making.

Blue Ribbon Defense Panel Reports

The Blue Ribbon Defense Panel was appointed by the President and the Secretary of Defense in July 1969, and given the following broad Charter, with instructions to submit its Final Report by July 1, 1970:

The general scope of the Panel is to study, report and make recommendations on:

(1) The organization and management of the Department of Defense, including the Joint Chiefs of Staff, the Defense Agencies and the Military Services, as it affects the Department's mission performance, decision-making process, the command and control function and facilities, and the coordination with other governmental departments and agencies, with emphasis on the responsiveness to the requirements of the President and the Secretary of Defense.

(2) The Defense research and development efforts from the standpoints of mission fulfillments, costs, organization, time and interrelation with the scientific and industrial community.

(3) The Defense procurement policies and practices, particularly as they relate to costs, time and quality.

(4) Such other matters as the Secretary may submit to it from time to time.

It is important to note that, while the Charter is very broad as to the Panel's function in the fields of structure, organization, and operating procedures of the entire Department of Defense, it excludes considerations of broad national policy. The Panel has endeavored to hew closely to this line.

While the members of the Panel have considered carefully the entire report, this does not necessarily mean that there is complete agreement with every detail of each recommendation or statement. Except where otherwise noted, however, there is agreement with the substance of every important conclusion and recommendation. The nature of the general agreement and the extent of incidental disagreement are those to be expected when members of a Panel individually have given serious thought to a major and complex problem, and have sought to achieve a joint resolution in furtherance of the Panel's task as a deliberative body.

[There were] concurring statement by Dr. George Stigler, and dissenting statements by Mr. Robert C. Jackson and Mr. Wilfred J. McNeil.

Gilbert W. Fitzhugh, Chairman

Executive Summary

The purpose of this summary is to provide a quick review of the six-chapter report resulting from the year-long study by the Blue Ribbon Defense Panel. The Panel's report offers recommendations in a number of areas including organization, management of materiel resources, management procedures, personnel management and conflicts of interest. This summary covers the major recommendations of the Panel in the area of the organization of the Defense Department and several of the more significant recommendations in the other areas.

As a result of its examination of the Defense Department, the Panel found that:

• Effective civilian control is impaired by a generally excessive centralization of decision-making authority at the level of the Secretary of Defense. The Secretary's ability to selectively delegate authority and decentralize management, while still retaining personal authority on major policy issues of the Department, is seriously inhibited by the present organizational structure.

• The President and the Secretary of Defense do not presently have the opportunity to consider all viable options as background for making major decisions, because differences of opinion are submerged or compromised at lower levels of the Department of Defense.

• There are too many layers of both military and civilian staffs, and staffs are too large in the Office of the Secretary of Defense (OSD), the Military Departments extending down through the field commands, the Joint Chiefs of Staff and the Unified and Component Commands. The results are excessive paper work and coordination, delay, duplication and unnecessary expense.

• The present arrangement for staffing the military operations activities for the President and the Secretary of Defense through the Joint Chiefs of Staff and the Military Departments is awkward and unresponsive; it provides a forum for inter-Service conflicts to be injected into the decision-making process for military operations; and it inhibits the flow of information between the combatant commands and the President and the Secretary of Defense, often even in crisis situations.

• The Joint Chiefs of Staff could more effectively perform their important statutory role as principal military advisors to the President and the Secretary of Defense if they were relieved of the necessity of performing delegated duties in the field of military operations and Defense Agency supervision.

• The present combatant command structure does not facilitate the solution of many serious problems which materially affect the security of the nation. For example, recent advances in technology require much closer coordination in planning for and employing the forces of the Continental Air Defense Command and the Strategic Air Command than can reasonably be expected with two separate commands. Also, the present Unified Commands do not bring about unification of the Armed Forces, but rather are layered with Service component headquarters and large headquarters' staffs.

• There is substantial room for improvement and greater integration of management throughout the supply, maintenance and transportation systems of the Department. The most critical need for improved effectiveness is in the support of the Unified Commands.

• There is no organizational element within OSD with the capability or the assigned responsibility for objectively making net assessments of U.S. and foreign military capabilities.

• There is no adequate organizational element within OSD that is charged with the responsibility for long-range planning for the structuring and equipping of forces or for other similar purposes.

• No formal mechanism exists within OSD to assure adequate coordination among the various elements of the Department.

• The present functional assignments of Assistant Secretaries of the Military Departments contribute to duplication between the efforts of the Military Department Secretariats and the Service military staffs, and also

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Claude Young,
Office of Commissioner,
Professional Football.

Dr. Peterson found it necessary to resign from the panel due to the pressure of her duties as President of Barnard College. Dr. Goldberger resigned due to illness.

between the Military Department Secretariats and OSD.

• The policies of the Department on development and acquisition of weapons and other hardware have contributed to serious cost overruns, schedule slippages and performance deficiencies. The difficulties do not appear amenable to a few simple cure-alls, but require many interrelated changes in organization and procedures.

• Operational test and evaluation has been too infrequent, poorly designed and executed, and generally inadequate.

• Procurement procedures do not sufficiently reflect the national need to maintain an adequate, but not excessive, industrial base.

• The promotion and rotation systems of the Military Services do not facilitate career development in the technical and professional activities, such as research and development, procurement, intelligence, communications and automatic data processing.

• The acquisition and retention of officers and enlisted men in the Armed Services are becoming increasingly difficult for a number of reasons, including (1) personnel policies with respect to compensation, promotion and retirement, and (2) the negative attitude of segments of the public.

• While policies on equal employment opportunity for military and civilian personnel and for contractors appear adequate, implementation responsibilities and functional assignments are fragmented and diffused and have impaired the achievement of effective results.

• The statutes and regulations regarding conflicts of interest are ambiguous, conflicting, and inequitable, and are not uniformly enforced.

To effect substantial improvement in these conditions, the Panel makes the following recommendations:

1. The functions of the Department of Defense should be divided into three major groupings:

(a) Military Operations, including operational command, intelligence, and communications (herein called Operations);

(b) Management of personnel and materiel resources (herein called Management of Resources); and

(c) Evaluation type functions, including financial controls, testing of weapons, analysis of costs and effectiveness of force structures, etc., (herein called Evaluation).

2. Each of these major groups should report to the Secretary of Defense through a separate Deputy Secretary. Appointees to these three positions should be drawn from civilian life, and should rank above all other officers of the Department of Defense except the Secretary. One of the three should be designated principal deputy. The General Counsel, the Assistant to the Secretary of Defense (Atomic Energy), the Assistant Secretary of Defense (Public Affairs), and the Assistant to the Secretary of Defense (Legislative Affairs) would continue to report directly to the Secretary of Defense. The staff of the Office of the Secretary of Defense should not exceed 2,000 people.

3. The Deputy Secretary of Defense for Management of Resources should be delegated responsibility for the following functions:

(a) The Military Departments, which should continue under the immediate supervision of their Secretaries;

(b) Research and Advanced Technology;

(c) Engineering Development;

(d) Installations and Procurement (a modification of the present Installations and Logistics);

(e) Manpower and Reserve Affairs;

(f) Health and Environmental Affairs;

(g) Defense Supply Agency; and

(h) Advanced Research Projects Agency.

There should be an Assistant Secretary of Defense for each of the functions (b) through (f) inclusive, who reports and provides staff assistance to the Secretary of Defense through the Deputy Secretary of Defense (Management of Resources). The position of Director, Defense Research and Engineering should be abolished, and his functions reallocated between the Assistant Secretary of Defense for Research and Advanced Technology and the Assistant Secretary of Defense for Engineering Development.

Functions (g) and (h) should continue to be constituted as Defense Agencies, each under the immediate supervision of a Director.

The Advanced Research Projects Agency should be delegated the responsibility for all research and exploratory development budget categories. Funds for such research should be budgeted directly to this Agency, and the Agency should be authorized to assign or contract for work projects to laboratories of the Defense Department or in the private sector, as appropriate.

4. The Deputy Secretary of Defense for Operations should be delegated responsibility for the following functions:

(a) Military Operations;

(b) The Unified Commands;

(c) Operational Requirements;

(d) Intelligence;

(e) Telecommunications (and Automatic Data Processing);

(f) International Security Affairs;

(g) Defense Communications Agency; and

(h) Civil Defense Agency (if Civil Defense is to be retained in the Department of Defense).

Three new major Unified Commands should be created:

• A Strategic Command, composed of the existing Strategic Air Command, the Joint Strategic Target Planning Staff, the Continental Air Defense Command, and Fleet Ballistic Missile Operations;

• A Tactical (or General Purpose) Command, composed of all combatant general purpose forces of the United States assigned to organized combatant units; and

• A Logistics Command, to exercise for all combatant forces supervision of support activities, including supply distribution, maintenance, traffic management and transportation.

No Commander of a Unified Command should be permitted to serve concurrently as Chief of his Military Service.

The responsibilities now delegated to the Joint Chiefs of Staff by the Secretary of Defense to serve as military staff in the chain of operational command with respect to the Unified Commands, and all other responsibilities so delegated which are related to military operations and the Unified Commands, should be assigned to a single senior military officer, who

should also supervise the separate staff which provides staff support on military operations and the channel of communications from the President and Secretary of Defense to Unified Commands. This officer should report to the Secretary of Defense through the Deputy Secretary of Defense (Operations). This senior military officer could be either the Chairman of the Joint Chiefs of Staff, as an individual, not ex-officio, the Commander of the Tactical Command, or some other senior military officer, as determined by the President and the Secretary of Defense.

There should be an Assistant Secretary of Defense for each of the functions (c) through (f), inclusive, who reports and provides staff assistance to the Secretary of Defense through the Deputy Secretary of Defense (Operations). The Defense Communications Agency and the Civil Defense Agency would each be under the immediate supervision of a Director.

All intelligence functions of the Department of Defense and all communications functions should report to the Secretary of Defense through the Deputy Secretary of Defense for Operations.

5. The following steps should also be taken:

(a) To provide the staff support on military operations, and the channel of communications from the President and the Secretary of Defense to the Unified Commands, an operations staff, separate from all other military staffs, should be created.

(b) The responsibilities now delegated to the Joint Chiefs of Staff by the Secretary of Defense to serve as military staff in the chain of operational command with respect to the Unified Commands, and all other responsibilities so delegated which are related to military operations and the Unified Commands, should be rescinded; and consideration should be given to changing the title of the Chief of Naval Operations to Chief of Staff of the Navy.

(c) All staff personnel positions in the Organization of the Joint Chiefs of Staff and in the headquarters military staffs of the Military Services which are in support of activities, such as military operations, which are recommended for transfer to other organizational elements, should be eliminated.

(d) The Organization of the Joint Chiefs of Staff should be limited to include only the Joint Chiefs of Staff and a reconstituted Joint Staff limited in size to not more than 250 officers augmented by professional civilian analysts as required.

(e) The Unified Commanders should be given unfragmented command authority for their Commands, and the Commanders of component commands should be redesignated Deputies to the commander of the appropriate Unified Command, in order to make it unmistakably clear that the combatant forces are in the chain of command which runs exclusively through the Unified Commander;

(f) In consolidating the existing area Unified Commands into the Tactical Command, major organizational and functional advantages will be obtained by:

- Merging the Atlantic Command and the Strike Command;
- Abolishing the Southern Command and reassigning its functions to the merged Atlantic and Strike Commands;
- Abolishing the Alaskan Command and reassigning its general purpose function to the Pacific Command and its strategic defense functions to the Strategic Command; and
- Restructuring the command channels of the sub-unified commands.

(g) The responsibilities related to civil disturbances currently delegated to the Army should be redelegated to the Tactical Command; and

(h) The Unified Commanders should be given express responsibility and capability for making recommendations to the Deputy Secretary of Defense for Operations, for operational capabilities objectives and for allocations of force structures needed for the effective accomplishment of the missions assigned to their Commands.

6. The Deputy Secretary of Defense for Evaluation should be delegated the responsibility for evaluation and control-type activities, including:

(a) Comptroller (including internal audit and inspection services);

(b) Program and Force Analysis (a modification of the present Systems Analysis Unit);

(c) Test and Evaluation;

(d) Defense Contract Audit Agency; and

(e) Defense Test Agency.

There should be an Assistant Secretary of Defense for each of the functions (a) through (c) inclusive, who reports and provides staff assistance to the Secretary of Defense through the Deputy Secretary of Defense for Evaluation.

The Defense Contract Audit Agency should be continued as a Defense Agency, under the immediate supervision of a Director.

A Defense Test Agency should be created to perform the functions of overview of all Defense test and evaluation, designing or reviewing of designs for test, monitoring and evaluation of the entire Defense test program, and conducting tests and evaluations as required, with particular emphasis on operational testing, and on systems and equipments which span Service lines. The Defense Test Agency should be under the supervision of a civilian Director, reporting to the Secretary of Defense through the Deputy Secretary of Defense for Evaluation.

7. The number of Assistant Secretaries in each of the Military Departments should be set at three, and except for the Assistant Secretaries (Financial Management), they should serve as senior members of a personal staff to the Secretaries of the Military Departments without the existing limitations of purview imposed by formal functional assignments. The Assistant Secretary (Financial Management) should become the Comptroller of the Military Department, with a military deputy, as in the current organization in the Department of the Navy.

The Secretariats and Service Military Staffs should be integrated to the extent necessary to eliminate duplication; the functions related to military operations and intelligence should be eliminated; line type functions, e.g., personnel operations, should be transferred to command organizations; and the remaining elements should be reduced by at least thirty percent. (A study of the present staffs indicates that the Secretariats and Service staffs combined should total no more

than 2,000 people for each Department).

8. Class II activities (Army), Field Extensions (Air Force), and Commands and Bureaus (Navy), all of which are line, rather than staff in character, which are now organizationally located under the direct supervision of staff elements in the headquarters military staffs of the Services, should be transferred to existing command-type organizations within the Services.

9. The Defense Atomic Support Agency should be disestablished. Its functions for nuclear weapons management should be transferred to the operations staff under the Deputy Secretary of Defense for Operations, and its weapons effects test design function should be transferred to the Defense Test Agency.

10. The administration functions presently assigned to the Assistant Secretary of Defense (Administration) should be assigned to a Director of Pentagon Services, reporting to the immediate office of the Secretary of Defense. He should be responsible for operating the facilities and providing administrative support for the Washington Headquarters.

11. A Net Assessment Group should be created for the purpose of conducting and reporting net assessments of United States and foreign military capabilities and potentials. This group should consist of individuals from appropriate units in the Department of Defense, consultants and contract personnel appointed from time to time by the Secretary of Defense, and should report directly to him.

12. A Long-Range Planning Group should be created for the purpose of providing staff support to the Secretary of Defense with responsibility for long-range planning which integrates net assessments, technological projections, fiscal planning, etc. This group should consist of individuals from appropriate units in the Department of Defense, consultants and contract personnel appointed from time to time by the Secretary of Defense, and should report directly to him.

13. A Coordinating Group should be established in the immediate office of the Secretary of Defense. The responsibilities of this Group should be to assist the Secretary of Defense and the Deputy Secretaries of Defense in coordinating the activities of the entire Department in the scheduling and follow-up of the various inter-Departmental liaison activities; to staff for the Secretary the control function for improvement and reduction of management information/control systems needed within the Department and required from Defense contractors; and to assure that each organizational charter of the Office of the Secretary of Defense is of proper scope and coordinated and in accordance with the assigned responsibility of the organization. The responsibility for the Department's Directive/Guidance System, currently assigned to the Assistant Secretary of Defense (Administration), should be assigned to this group. The coordinating group should be headed by a civilian Director, who should also serve as executive assistant to the Secretary of Defense.

14. The Army Topographic Command, the Naval Oceanographic Office and the Aeronautical Chart and Information Center should be combined into a unified Defense Map Service reporting to the Secretary of Defense through the Deputy Secretary of Defense for Management of Resources.

15. A new development policy for weapon systems and other hardware should be formulated and promulgated to cause a reduction of technical risks through demonstrated hardware before full-scale development, and to provide the needed flexibility in acquisition strategies. The new policy should provide for:

(a) Exploratory and advanced development of selected sub-systems and components independent of the development of weapon systems;

(b) The use of government laboratories and contractors to develop selected sub-systems and components on a long-term level of effort basis;

(c) More use of competitive prototypes and less reliance on paper studies;

(d) Selected lengthening of production schedules, keeping the system in production over a greater period of time;

(e) A general rule against concurrent development and production efforts, with the production decision deferred until successful demonstration of developmental prototypes;

(f) Continued trade-off between new weapon systems and modifications to existing weapon systems currently in production;

(g) Stricter limitations of elements of systems to essentials to eliminate "gold-plating";

(h) Flexibility in selecting type of contract most appropriate for development and the assessment of the technical risks involved;

(i) Flexibility in the application of a requirement for formal contract definition, in recognition of its inapplicability to many developments;

(j) Assurance of such matters as maintainability, reliability, etc., by means other than detailed documentation by contractors as a part of design proposals;

(k) Appropriate planning early in the development cycle for subsequent test and evaluation, and effective transition to the test and evaluation phase; and

(l) A prohibition of total package procurement.

16. The effectiveness of Program or Project Management should be improved by:

(a) Establishing a career specialty code for Program Managers in each Military Service and developing selection and training criteria that will insure the availability of an adequate number of qualified officers. The criteria should emphasize achieving a reasonable balance between the needs for knowledge of operational requirements and experience in management;

(b) Increasing the use of trained civilian personnel as program managers;

(c) Providing authority commensurate with the assigned responsibility and more direct reporting lines for program managers, particularly those operating in matrix organizational arrangements; and

(d) Giving the program manager directive authority, subject to applicable laws and regulations, over the contracting officer, and clarifying the fact that the contract auditor acts in an advisory role.

17. Increased use should be made of parametric costing techniques for developments and procurements to improve the quality of original and subsequent estimates, and to help offset the difficulties of estimating the costs

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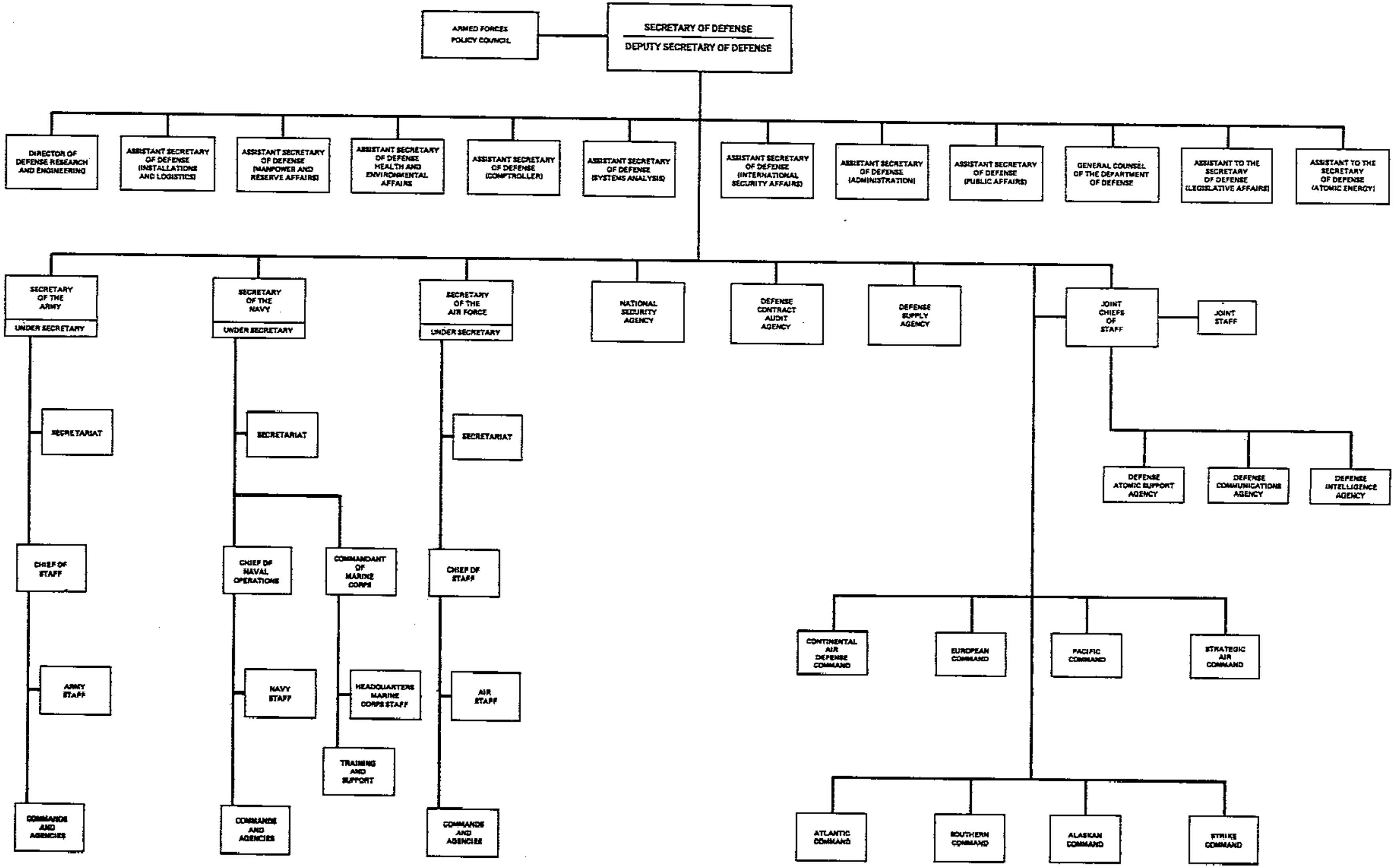

of unknowns.

18. A separate program category[1] should be established for test and evaluation, especially operational testing, and the responsibility for overview of all Defense test and evaluation efforts should be assigned to the Defense Test Agency.

[1] *Program categories are those categories of activities used for internal planning and management in the Department, e.g., strategic offensive forces, strategic defensive forces, research and development, intelligence, etc.*

19. Specialist careers should be established for officers in such staff, technical and professional fields as research, development, intelligence, communications, automatic data processing, and procurement.

20. In order to improve the process of acquisition and retention of military personnel, the Executive Branch should develop, and submit to the Congress for its consideration as necessary, a total military personnel program which coordinates and reconciles all the separate considerations, particularly including: (1) military compensation and retirement, (2) personnel policies on promotion and rotation, and (3) acquisition programs, such as Reserve Officers Training Corps.

21. The duration of assignments for officers should be increased, and should be as responsive to the requirements of the job as to the career plan of the officer. Officers continued on an assignment for this reason should not be disadvantaged in opportunity for promotion.

22. Executive Orders and Department of Defense Directives with respect to matters of equal employment opportunity for Department of Defense military personnel, civilian em-

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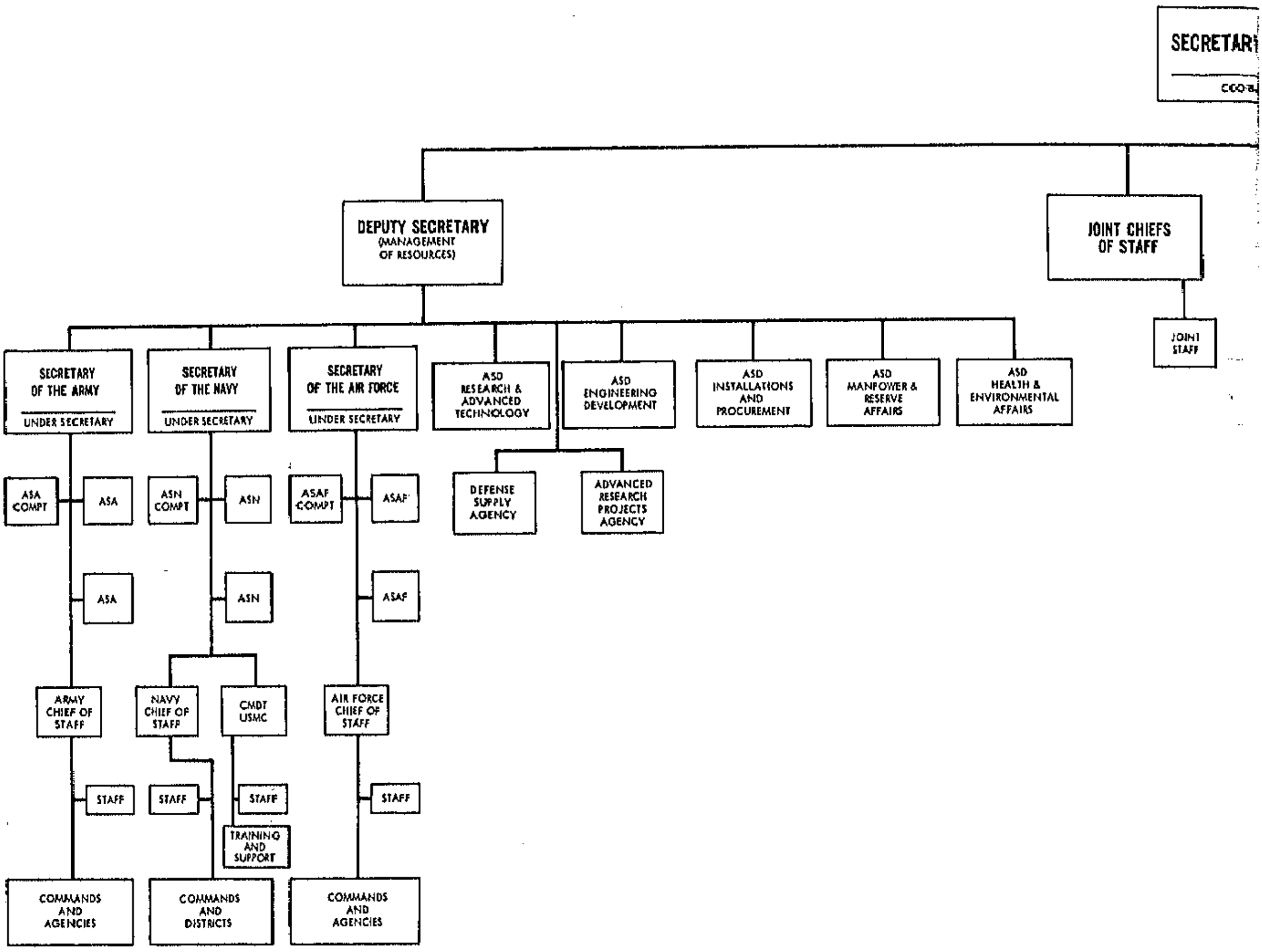

ployees and contractors, as set forth in the existing comprehensive programs for insuring equal opportunity, should be administered from a sufficiently high organizational level in the Department to assure effective implementation, and the procedures for assessing penalties for non-compliance should be reviewed and clarified.

23. The Secretary of Defense should recommend clarifying changes in conflict of interest statutes, should amend the regulations to clarify them, and should make certain administrative changes to insure uniform enforcement.

Organization

In approaching its task, the Panel became increasingly aware that no single organization or set of procedures would be adequate for the Department of Defense for all times. The organization and procedures of the Department must be sufficiently flexible to respond to a changing environment and evolving objectives.

Certain principles which guide organizational and procedural objectives do remain constant. First among such principles is the requirement for effective civilian control of the Defense establishment. Under the Constitution, civilian control is exercised through the combined efforts of both the Executive and Legislative Branches. Its effectiveness, however, depends in large measure on the capability of the Secretary of Defense to insure consistency of Department operations with policy, to surface the viable alternatives on major issues, and to maintain a high degree of visibility to himself, the President and the Congress of the functioning of the national Defense establishment.

Effective control of the military es-

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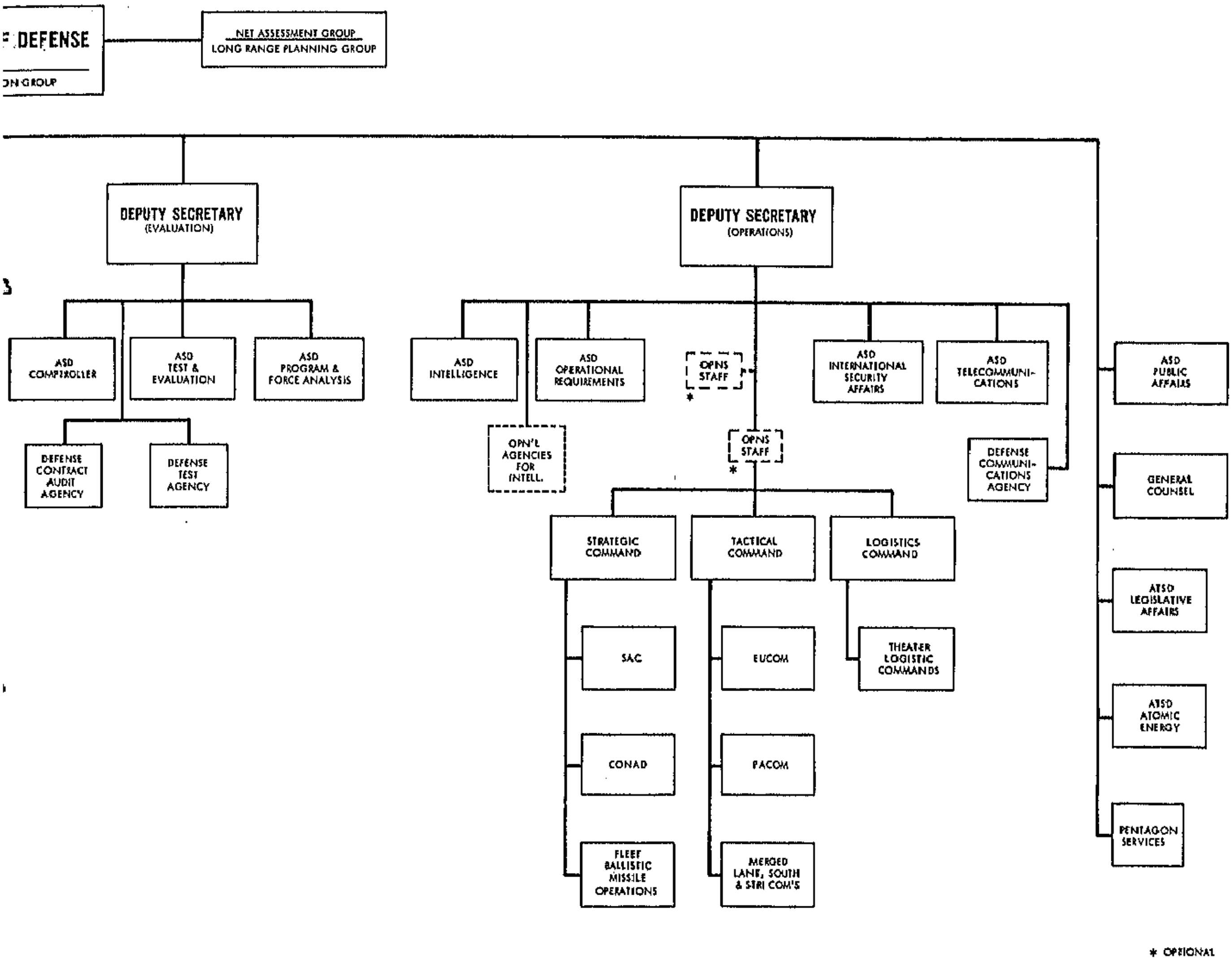

tablishment by the Secretary is required not just for the purpose of insuring the supremacy of civil authority. While the President and the Secretary of Defense must have the benefit of professional military advice based on careers of military training and experience, unified control is essential to provide the Nation with maximum security at minimum costs, and to insure that military strategy, force structure and operations are consistent with national policy.

Despite the broad authority vested in the Secretary of Defense by the National Security Act of 1947, as amended, experience demonstrates that in practice, the tools available to the Secretary to exercise effective control of the Department are seriously deficient.

* * * * *

The fundamental principles of the National Security Act of 1947, as amended, are still sound. Although experience indicates the desirability, and even the necessity, for some substantive changes, many of the deficiencies evident in the operation of the Department could be remedied by more faithful application of the concepts on which the Act is premised.

The Department of Defense is too large, and encompasses too many complex and diverse activities to respond to over-centralized management. Some logical division of activities must be made to facilitate management and control. However, achieving such division by radical reorganization would probably solve few, if any, of the basic conflicts which now exist; its effect would be more likely to relocate the organizational points at which divergent interests lock in controversy. There is also the danger that valuable morale factors rooted in tradition might be destroyed rather than controlled, or eliminated rather than redirected toward useful objectives.

A drastic restructuring would also inevitably risk serious disruptions of uncertain degree and duration in the operational capabilities and readiness of our military forces. In view of the current and foreseeable state of world affairs, only the most crucial need could justify acceptance of such risks.

* * * * *

Management of Materiel Resources

The modern history of military organizations and operations demonstrates that the materiel support of the forces is of ever-increasing relative importance, and presents complex defense management problems.

Advances in science and technology comprise the initiating source of this trend. Weapons, communications, transportation—all have been affected significantly by revolutionary advances in the state-of-the-art; and each advance has been accompanied by great increases in complexity of development, acquisition, maintenance, operation and in cost.

In short, modern military organizations have become "hardware" oriented and dependent. Military hardware requires an increasing amount and proportion of total defense resources, aggravating a host of inseparable, associated management problems.

Materiel management in the Department of Defense can be divided into two distinct overall areas of activity. The first is acquisition related, and includes functions associated with research, development, test and evaluation, and procurement. The second phase is post-procurement, and includes supply, maintenance, and transportation.

The most severe problems in the acquisition of materiel occur when production is dependent on new development, not with off-the-shelf procurements.

Military hardware development programs continue to be plagued by the now familiar symptoms of trouble:

(1) Major cost growths or overruns;

(2) Schedule slippages; and

(3) Failures in performance.

Uncertainty is inherent in the nature of programs which involve advances in technology, and this uncertainty makes it inevitable that some degree of cost growth, delays and short-falls in desired performance will occur in some programs. The frequency and magnitude of such problems which have been experienced, however, surpass significantly those which can be attributable to unavoidable causes. It is clear that a substantial portion of the acquisition problems must be attributed to management deficiencies.

The problems—and resulting deficiencies—in hardware development programs are clearly too myriad and complex to yield to any single solution, but a combination of changes in policy and procedures can achieve significant improvements in costs, time, and performance. . . .

Research and Development

* * * * *

There is no adequate or coherent planning for investments in advancing the technological base. Responsibility and management for conducting such research are widely fragmented among and within the Military Services and the Defense Agencies. Research funds so allocated have not always been spent on militarily-relevant technology, nor are all militarily-relevant areas of technology appropriately considered in the allocation of research funds.

Existing organization and procedures inhibit the degree of control on research and exploratory development work and of the expenditures necessary to insure proper application. The funds allocated to advancing the technological base are not sufficiently identifiable and auditable to support value judgments as to their sufficiency. There is no adequate mechanism to assure that funds appropriated for research and exploratory development are not diverted to advanced, or engineering development categories, or to operational systems developments. The overemphasis on mission justification for research and development allocations and funding creates additional incentives for such diversions.

There is no adequate mechanism to evaluate the performance of the numerous research groups. The dissipation of research, exploratory development and management and support categories of R&D funds on unproductive work in contractor and in-house laboratories, sometimes to support a preconception or position of the organizational element contracting for the research, occurs all too often.

Based on the foregoing observations, it is concluded that R&D to advance the technological base should be constituted as a separate program and subject to a continuing intensive review to insure that all funds are allocated to militarily-relevant research and that all militarily-relevant areas of technology are given due consideration in fund allocations. Further, Defense research policy should be separated by assignment of responsibility from other development policy. The primary objective should be to insure that technology will be available when needed to meet Defense requirements.

Recommendations

Research and Development to advance the technological base should be constituted as a separate program, under the staff supervision of the Assistant Secretay of Defense (Research and Advanced Technology). It should be subject to continuing intensive review to insure that available funds are allocated to militarily-relevant research and that all militarily-relevant areas of technology are considered in fund allocations.

The responsibility for control of Defense research designated to advance the technological base and the appropriated funds therefor should be assigned to the Advanced Research Projects Agency (ARPA). Further, ARPA should be directed to:

(a) Allocate its R&D among qualified performers;

(b) Assure by review the relevance of all projects and appropriateness of fund allocations;

(c) Evaluate the effectiveness of all its R&D participants; and

(d) Develop and submit for approval to the Deputy Secretary of Defense (Management of Resources) an annual Research Objective (RO) statement which would be a companion document to the Operational Capability Objectives developed by the Unified Commands and which would provide the Secretary of Defense an information base to determine the overall defense capability objectives.

Advanced, Engineering, and Operational Systems Development

A major problem with the requirements process occurs at its very beginning. The originating command often lacks the capability for operational validation which should be prerequisite to transmittal to higher Headquarters. The application of military judgment to requirements is essential, but not sufficient in itself. Operational validation should be based on a thorough analysis of the assigned mission and the present or programmed means for accomplishing it in the predicted threat environment. ... There is no doubt that the overall requirements process could be improved greatly by specifying that operations analysts study requirements at the point of origin. In this way, those requirements reaching higher headquarters should have greater validity.

* * * * *

Each Service has a large section in its Headquarters staff which has the sole function of translating the broadly-stated requirements received from field commands into more specific statements of their desires for new or improved weapons and other materiel. These staff elements also determine informally the relative priority of the requirements for new and improved weapons. In recent years, there has been a noticeable tendency for the formal requirements documents to become quite specific, and to be stated increasingly more in terms of engineering specifications rather than in terms of the performance or operational results being sought.

Even when the engineering specifications are properly matched to the performance requirements, the detailed engineering specifications limit the engineering alternative available to the developer because of the reluctance of the acquisition authority to consider change, thereby imposing on the development a rigidity which can cause delays, additional costs, and often the application of older technology than the current state-of-the-art would permit. In other instances, the specifications have the result of demanding products which are clearly beyond the state-of-the art or which require developmental efforts beyond those necessary to perform the prescribed mission. Inept or obsolete specifications also occur too frequently, and in some instances, products developed which satisfy the imposed engineering specifications will not perform the mission intended.

There is an apparent inability of Service staff elements to divorce themselves from their own Service interests in establishing priorities for requirements. It is evident that the needs of the user in the field often take second place to weapons developments considered most important to the particular Service for the protection or expansion of its assigned roles and missions.

The mission of the combatant forces should determine their required operational capbilities, which should be the principal factor in initiating development. This can be accomplished only if the combatant commands possess the capability to analyze their missions, determine their operational capabilities, deficiencies and potential deficiencies, and state their requirements in a meaningful way.

Recommendations

The Strategic, Tactical and Logistics Commands should be assigned the responsibility to develop, and submit to the Deputy Secretary for Operations, Operational Capability Objectives relating to their assigned missions. For this purpose, each Command and major sub-command Headquarters should be organized to include an operations analysis element.

For each Operational Capability Objective which is validated by the Deputy Secretary for Operations, the Deputy Secretary for Management of Resources should require one or more of the Military Departments to prepare and submit a development plan aimed at satisfying the Operational Capability Objective.

Advanced Development

Advanced Development, which includes all projects for development of hardware for experimental test, is the essential link between advances in the technological base achieved in Research and Exploratory Development, and the incorporation of improved capabilities in new weapons developments. In recent years, paper studies and analyses have often been substituted for essential hardware development and testing. As a result, uncertainties which could be eliminated or reduced are carried over into engineering development or operational systems develop-

ment, where unresolved technical problems are significantly more expensive and troublesome to remedy. In addition, new technology which would improve weapons capabilities is often lost in the process.

Increased emphasis on and funding of Advanced Development to yield various forms of prototype equipment, which can be tested prior to commitment in a weapon system, is essential. Prior to approval of initiation of Engineering or Operational System Development, test results of all major advances in the technological base considered for incorporation should be available.[2]

Engineering, Operational Systems Development

For purposes of special management control, Engineering Development and Operational Systems Development of major systems (defined as requiring total R&D financing in excess of $25 million or requiring a total production investment in excess of $100 million) are subjected to special procedures. . .

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During the contract definition phase, the technical and design approaches to the systems development contained in the proposal of a prospective contractor are often exposed to other prospective contractors, so that potentially better and/or less costly features of each proposal can be considered by other prospective contractors for incorporation in or adaptation to their own proposals. Industry generally considers this practice to constitute unethical conduct on the part of the Government, particularly since it has no counterpart in non-government business transactions. The potential inherent in this practice for its use by government personnel to influence the ultimate selection of a contractor is obvious.

The scope of a Request for Proposal (RFP) and the responses thereto in a major systems development, as prescribed, and as practiced until recently, are illogically broad. The central purpose of the contract is concerned with engineering development, a matter of considerable technical uncertainty. To expect and to require through Contract Definition that a contractor have the capability even to identify all end items of the system, let alone develop detailed specifications for each, in an advanced technological product, and concurrently to prepare reliable predictions in detail on the maintainability, reliability, and the requirement for operations training to use the product, is unreasonable. Experience proves this procedure impractical, and the many peripheral matters included during Contract Definition tend to obscure the critical issues of technical design and competence, as well as multiplying the cost of preparing and reviewing the proposals.

The mandatory requirement for a formal Contract Definition has a serious impact on the entire development process. While there are cases where the contract definition process is useful, there are others in which there is no logical need for the exercise. Contract Definition is both time consuming and costly. Twelve-to-eighteen months can be devoted to paper preparation and review with little, if any, actual development work going on, and the cost to the Department for a Contract Definition exercise can exceed one hundred million dollars. Such a procedure should be required only on a case-by-case basis, rather than on a mandatory basis presently prescribed in Department of Defense Directive 3200.9.

There are also problems involved in the source selection process. Past experience indicates that both weighted and raw scores on responses to RFPs tend to be very close in major source selections. In some instances, contractors reverse positions in going from raw scores to weighted scores, but even then the competitors tend to be almost equal. In this situation, it appears that, generally, the unweighted factors, such as cost and past performance, have a large and perhaps controlling impact on the final selection. Apparently, the large number of peripheral technical elements included in the ratings is the major factor which normalizes the scores of the competitors. Reduction of the number of elements rated would focus attention on the more fundamental considerations, and would give a broader perspective of the relative technical merits of each contractor's proposal.

The systems development approach continues to accumulate in one program a dangerously high magnitude of risks, from both cost and technology standpoints. Development problems connected with one or two of the many critical components of the system can cause schedule slippages which occasion enormous cost consequences. Even in the absence of major technical difficulties, an accumulation of changes in a variety of components, each relatively small in cost, can have a total cost impact of great magnitude.

This emphasis on developing all elements for the system as part of a single development project, as contrasted to selected subsystem and component development, also has the effect of reducing the number of development actions and raising the level of commitment for each development contracted. Among the more far-reaching consequences is that competition is limited to a few large contractors on most major development projects. In addition, because subcontractors for sub-elements of the system are often tied to a specific prime contractor, there is the potential of inadequate flexibility to obtain the best qualified developer for each sub-element of the system.

The prescribed procedure for major systems development places heavy emphasis on fixed-price type contracts, apparently on the assumption that technical risks have been minimized by previous efforts. Fixed-price type contracts have been equated, in effect, with competition. This competitive pricing during Contract Definition has led to significant underpricing in numerous development contracts. As a result, cost overruns have been frequent and substantial. The concentration of risks in a single contractor is often out of proportion to the contractor's financial structure and capability, and can result in the Department of Defense being faced with either permitting a default on a critical program, or of salvaging the particular company with payments not clearly required under the terms of the contract.

Fixed-price contracting requirements also create additional pressures for rigid and frozen design and performance specifications which, in turn, restrict the flexibility of the developer

[2] *See Operational Testing and Evaluation, page 32.*

to make engineering trade-offs. This factor inhibits the developer's capability to achieve the best product.

In addition, the prescribed process by its very terms contemplates a high level of concurrency of development and production which, in practice, has proved to be fraught with propensities for cost growths, schedule delays and performance failures.

In practice, the prescribed process for major systems development produces an unwarranted reliance on paper analysis during Concept Formulation and Contract Definition. A review of major systems developments clearly indicates that although there had been a proliferation of studies in Concept Formulation, the necessary technology to proceed with Engineering Development frequently had not been accomplished through Exploratory and Advanced Development programs. Assumptions that all technical problems can be foreseen prior to the commencement of Engineering Development have proved to be wrong. Repeated experiences demonstrate that technical uncertainty is inherent in the Engineering Development process and that paper studies alone cannot enable government or industry to forecast all of the problems that will arise. Since it has been assumed that the technical risk is low in the development, it is not surprising that cost estimates, based on paper analyses rather than tested hardware, have proved to be unreliable. This marked tendency to substitute paper analysis for hardware development has serious adverse consequences.

From the review of major weapon system acquisitions, a major revision of policy is required to: (1) introduce flexibility in selecting the strategy or technique to be used for any given system development; (2) place more emphasis on hardware development during Concept Formulation to reduce technical risks; (3) undertake incremental development of subsystems and components independent, in the initial stages, from major system developments; and (4) introduce multiple decision points during the development and acquisition of new systems.

If more emphasis and direction is given to the advancement of the technological base as previously recommended, then the flow of technology would come from a broad base of research through exploratory and advanced developments into component and subsystem developments and subsequently into new system developments or modification programs to existing systems. This approach would both minimize technical risk and increase the number of options available to satisfy Operational Capability Objectives of the Commands.

Recommendations

A new development policy for weapon systems and other hardware should be formulated and promulgated to cause the reduction of technical risks through demonstrated hardware before full-scale development, and to provide the needed flexibility in acquisition strategies. The new policy should provide for:

(a) Exploratory and advanced development of selected subsystems and components independent of the development of weapon systems;

(b) The use of government laboratories and contractors to develop selected sub-systems and components on a long-term level of effort basis;

(c) More use of competitive prototypes and less reliance on paper studies;

(d) Selected lengthening of production schedules, keeping the system in production over a greater period of time;

(e) A general rule against concurrent development and production, with the production decision deferred until successful demonstration of developmental prototypes;

(f) Continued trade-off between new weapon systems and modifications to existing weapon systems currently in production;

(g) Stricter limitations of elements of systems to essentials to eliminate "gold-plating";

(h) Flexibility in selecting type of contract most appropriate for development and the assessment of the technical risks involved;

(i) Flexibility in the application of a requirement for formal contract definition, in recognition of its inapplicability to many developments;

(j) Assurance of such matters as maintainability, reliability, etc., by other means than detailed documentation by contractors as a part of design proposals;

(k) Appropriate planning early in the development cycle for subsequent test and evaluation, and effective transition to the test and evaluation phase; and

(l) A prohibition of total package procurement.

Department of Defense Directive 3200.9, Initiation of Engineering Development, should be rescinded.

Research and Development undertaken to satisfy specific military materiel requirements should be under the staff supervision of the Assistant Secretary of Defense (Engineering Development).

The Advanced Research Projects Agency (ARPA) should be required to provide a formal technical risk assessment on all proposed new systems prior to the approval of the Development Concept Paper (DCP).

Special Problems in Acquisition of Navy Ships

The problems found to exist in the major weapon systems acquisition process, generally, are as applicable to the acquisition of Navy ships as to other weapon systems. In addition, however, Navy ship procurement and construction suffer from several unique problems.

The most sigificant differences in Navy ship procurement derive from the fact that the Navy Department is the only customer which buys from its suppliers the types of ships involved. An aircraft manufacturer has potential customers in the Air Force, the Navy, the Army and numerous private air carriers, but the constructors of aircraft carriers and submarines must sell to the Navy, or no one.

As a consequence, the procurement process for Navy ships, even more than in other procurements, must reflect a concern for the existence of a sufficiently broad industrial base to provide competition for such procurements.

The procurement of ships involves a construction process more than a production process. Accordingly, economies of scale are not as readily available as in other major weapon systems acquisitions. While prototyping may not be as feasible for entire ships as for other weapon systems, there is a potential for improvement in the Navy ship acquisition process through

prototyping of sub-elements.

In recent years, the emphasis has been heavily weighted toward designing into each ship approved for construction the greatest total capability possible. This reflects inadequate consideration in the requirement process for the trade-off advantages of a larger number of ships of less individual capability as compared to fewer ships of maximum individual capability.

Minor Weapons Development

Although Defense management emphasis is heavily focused on major system development, the far more numerous "minor" engineering developments account for approximately three times the level of expenditure associated with major systems. Subsequent procurements do not change the proportion; for when RDT&E and procurement funds are combined, expenditures for "minor" systems are also approximately three times those for major systems.

Although the formal process prescribed for major system development is optional for other engineering developments, the pattern of concept formulation, contract definition and development, and indeed, the entire systems concept, has largely permeated the "minor" weapons and systems developments. There is one notable exception to the major systems process, and that is the absence of high-level management attention to "minor" developments until things really go badly.

In large measure, minor system developments experience the same problems and exhibit the same symptoms that are found in major systems. Some problems, however, are peculiar, either in character or degree, to minor developments. Among these problems is the inadequate level of technical and managerial competence of Defense personnel assigned to operate the minor developments process.

The pay is low by industrial standards for jobs of comparable responsibility, billets are limited and opportunities for professional growth and diversity are inhibited by the requirements of the job. The Government engineer on a small system may write technical sections of the RFP, evaluate the proposals, prepare the work statement for the winner, provide technical direction for the development effort, write the test specifications, perform the engineering tests and provide technical guidance to management, all single-handedly.

Management of the acquisition process is not a career specialty for military officers. In smaller programs, they are often, if not usually, untrained in business methods and technology. They are well versed in the operational aspects of the equipment, but their background and experience often make them ill at ease with cost/time/performance trade-offs and with their industrial counterparts and their problems. There is evidence that the Services do not have adequate skills to evaluate the capability of potential suppliers, particularly in the manufacturing area.

Recommendation

In concert with the new development policy recommended for major weapons systems, the same increased flexibility of techniques should be provided for minor systems.

Procurement of Proprietary Items

The broad spectrum of items procured by and for the Department of Defense extends from the smallest and most commonplace items to the most sophisticated and complex systems. In this process, private innovators make a very significant contribution. The individual items or components, procured separately or as part of subsystems, are or were once the products of an innovator. It must be recognized that the traditional incentives which lead people to invest their time, talent, and resources in inventing improved products in competition with others (called proprietary items[3]), are responsible in no small part for the technological process of our Nation in both domestic and military areas.

Even though the Department recognizes and stresses the importance of private innovation in introductory policy statements in the Armed Services Procurement Regulation (ASPR) sections on Patent Rights and Rights in Data, the spirit of the policy is often not apparent in the implementation of procurement practices.

Procurement practices presently in use throughout the Department of Defense and other agencies which buy for the Department (e.g., General Services Administration) often tend to establish "negative incentives" for the private innovator to enter the Defense market. Suppliers are often selected and contracts awarded primarily on the basis of price alone, with less than adequate regard for quality, reliability, delivery schedule, improvement of products, or maintenance of production (or innovative) capacity. Reverse engineering, that is preparing the necessary data to manufacture the product by examining the product itself, is used by the Government to establish new suppliers purely to maintain the assumed necessity of having more than one competitive source. Adverse disclosures by manufacturers and suppliers of catalog items frequently are needlessly required by data acquisition practices. In summary, the basic problem with respect to procurement practices for proprietary items is the deviation of procurement practices from the policy of encouraging innovation, and the belief by Government buyers that it is their duty to force a price competition.

A significant concern with respect to patents is the increasing number of instances in which the Department of Defense takes ownership of patents developed on contract, rather than acquiring license rights for government use, with the contractor retaining the rights for commercial use. To attract the fullest competition of the best qualified companies, the Department's patent policy should require only the granting to the Government of a non-exclusive, royalty-free license under patents for inventions made in the performance of the contract, and not a license under background patents of the contractor. A policy of

[3] *The following definition was taken from "Webster's Third New International Dictionary":* PROPRIETARY ITEM—an item that is protected by secrecy, patent, or copyright against free competition as to name, composition, or process of manufacture. *In common parlance, the term is often used to refer to an item developed by a manufacturer at his own expense and offered by him as a standard item for sale to a large number of customers.*

seeking rights in background patents or the taking of title to inventions by the Government, tends to discourage the best-qualified companies from accepting or, in some cases, competing, for contracts. This results in the Department of Defense having to accept less qualified companies, and the strong possibility of reduced competition for its contracts. This does not result in achieving the Department's principal objective, which should be to obtain the best results at the desired time and at the most reasonable price.

The Department's data policy provides very limited protection for previously-generated proprietary data. The Department's data policy must enable it to perform its missions in the most effective and economical manner consistent with its long-term needs, and in a manner which most effectively maintains the technological base upon which it depends, while taking full advantage of the incentives of the competitive free enterprise system.

It is important for the Government to undertake a rededication and re-establishment of adherence to its oft-stated policies for motivating and protecting the private innovator. The Department of Defense should recognize and reverse certain trends within its components which are having the effect of stifling the initiative to invent or innovate. The Department should also recognize that, while obtaining only that proprietary information essential to accomplishing Government purposes, the price should be commensurate with the value of the information received.

Recommendation

The stated policy of the Department of Defense to provide incentives to encourage private innovators' participation in the development of defense products should be reaffirmed and promulgated. The reaffirmation of policy should be supplemented by directives:

(a) To improve procurement practices by requiring the submittal of bid samples in the procurement of catalog items;

(b) With respect to patent rights, to define "Subject Inventions": as

(1) Those inventions originally conceived pursuant to the research and development work specifically called for by a Government contract; and

(2) Those inventions conceived prior to the award of a Government research and development contract which have not been reduced to practice constructively or actually prior to said award, and are first actually reduced to practice pursuant to the research and development work specifically called for by the contract; and acquire for the Government a royalty free non-exclusive license in patents based on Subject Inventions, for Governmental purposes; and

(c) With respect to Rights in Data, to obtain only that proprietary data essential to accomplishing Governmental purposes other than manufacture or reprocurement, and to establish new basic categories of data rights:

(1) Unlimited—including publication rights;

(2) Limited—prohibited for reprocurement or manufacture, and

(3) Production—right to use (license) for procurement and manufacture.

Program Management

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Top Defense management attention is frequently given only to those developments with high public visibility. The concentration of top Defense management attention on these selected major systems has permitted program management for less visible major systems and for minor developments to continue to flounder. Significantly, recently undertaken corrective action has been directed at major high-cost and controversial programs. Unfortunately, there are far too many development programs for each to be addressed on an ad hoc basis. Basic directives must be modified and ground rules must be devised for program management in general if the fundamental weaknesses of program management are to be eliminated.

The weaknesses of program management have been increasingly aggravated by the growing breadth of responsibility and complexity of tasks of the Program Manager. With the increased application of the systems concept of development, Program Managers find themselves responsible for administering a fixed-price contract for development of a product to detailed design specifications in which they are permitted little flexibility for technical trade-offs. In systems developments, a Program Manager is also likely to be given responsibility which encompasses a span of sub-elements involving a wide variety of disciplines and technological skill, the aggregate of which he may well be inadequately trained to handle.

A shift in emphasis toward separate component developments, as previously discussed, could result in a more feasible scope of management for the Program Manager, and thereby contribute more to the elimination of program management weaknesses than would any particular change in the organization of reporting relationship of the project management.

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Management Systems

During the past decade, the trend in government contracts for developments has shifted markedly from cost-plus-fixed-fee toward fixed-price contracts, many of which have embodied incentive features. On the surface, this trend would appear to diminish the required level of detailed management by the Defense Department of Contractors' activities. Paradoxically, however, the same period has been marked by a multiple increase in the number and detail of management control systems contractually imposed by the Defense Department.

A number of factors evidence the excessiveness of the existing level of management control systems. For example, the sheer volume of reporting requirements exceeds, by a substantial margin, the review capability of managers within the Department of Defense. More significantly, the increase in management control systems has not cured the cost overrun or schedule delay problems. A reduction in management control systems would both reduce the reporting load imposed on industry by that portion which is duplicative or serves no useful purpose, reduce the cost to the Department, and improve the effectiveness of management control.

This problem has been formally recognized and acknowledged since 1966, when the Department initiated a management systems control project, and established an office under the Assist-

ant Secretary of Defense (Comptroller) as the central responsibility within the Department for this area. In 1968, sound policy guidance was issued and two Department of Defense Instructions to implement that guidance were published.

Despite the issuance of policy statements and the assignment of specific responsibility for the control of development of management control systems for use in the acquisition process by the Department of Defense, there has been little standardization or reduction in the number of management control systems contractually applied. So many management control systems now exist that the process of review and analysis, to determine what should be the revisions and consolidations and/or cancellations of the thousands of existing management control systems documents, consumes an inordinate amount of time. . . .

Recommendation

The Secretary of Defense should establish a small staff within the Coordinating Group reporting to him and assign it the responsibility of effecting both a major improvement and reduction in the control and information needed for management within the Defense Department and, in turn, of its defense contractors. This should be done by specifying what is required, not dictating how to manage. Immediate top-level support to follow the current management system control project through to its successful conclusion should be one of the first actions. Included in this action should be direction to implement Instructions 7000.6, "Development of Management Control Systems Used in the Acquisition Process," and 7000.7, "Selection and Application of Management Control Systems in the Acquisition Process," with the control responsibility specified therein for the Assistant Secretary of Defense (Comptroller) reassigned to the Coordinating Group.

Cost Estimating

Studies reveal that on the average, cost estimates on major systems developments have probably improved in relative accuracy over the past fifteen years. So many variables affect the evaluation of cost estimates, however, that confidence in such a conclusion must be qualified. In any event there is much room for improvement.

Cost estimating for development programs has apparently been too widely credited in the Defense Department, in industry, in the Congress and by the public with a potential for accurate prediction which is belied by the inherent technical uncertainties in developments. The precise problems which may be encountered in the process of attempting to convert a technological or scientific theory or experiment into practical, producible application cannot be foreseen with accuracy. It should be axiomatic that one cannot place a price on an unknown; yet, the increased resort to fixed-price contracts, the use of precontractual cost estimates as a firm baseline for measuring performance throughout the life of the system, and the shock reaction which is forthcoming when cost overruns or growths are experienced, all evidence an unwarranted degree of confidence in cost estimates.

The inherent limitations on cost estimation imposed by technological uncertainties cannot be completely overcome. Other factors, however, also contribute to the inaccuracies of cost estimates. The understandable incentives to sell a development program, either to senior decision makers in the Executive Branch or to Congress, can influence cost estimates to be on the low side. Contracting policies and procedures also have a tendency to suppress the level of cost estimates. The cost estimates must be used as a basis for requesting and justifying authorizations and appropriations. In addition, the competitive pressures on prospective contractors during Contract Definition, as previously discussed, leads to overoptimistic proposals which support the original cost estimates rather than take into account the possible effects on costs of the inherent uncertainties.

"Parametric" cost estimation techniques offer the potential for improved planning of cost factors. These parametric techniques require the analysis of historical data to establish some broad gauge such as cost per pound for component units of the program being evaluated. The broad nature of the product of this type of analysis precludes detailed comparison with the estimated program costs developed from its elements, but the difference in gross totals can indicate a probable range of magnitude of the costs of contingencies. The Department has, to some extent, recognized a significant portion of their potential. The use of the parametric approach to cost estimation is, of course, a clear acknowledgement of the inherent limitations and imprecision of any cost prediction methods.

Whatever method or methods of cost estimating are used, the availability of a data base on previous programs is essential, and the extent of availability of such data in usable form is a limiting factor on the potential accuracy of cost predictions. Efforts are being made to collect systematically and preserve such data on contemporary developments. Only time will provide an improved data base for projection.

The potential accuracy of cost estimates also varies according to the time period in which it is made, relative to the phase of the development program. Cost estimates made early in the concept formulation phase cannot be expected to yield the accuracy which is possible for such an estimate made after the first stage of actual development.

Cost estimating capabilities also fluctuate with the relative complexity of developments. They are most difficult and least credible for complex operational system developments.

While every effort should be made to improve cost estimation capabilities through compilation of a more extensive data base, wider use and more reliance on parametric techniques and a continuous effort to achieve objectivity in estimation, the most fundamental problems associated with cost estimation cannot be resolved without a general recognition and acknowledgement of the inherent limitations of cost estimates for development programs.

For this reason, the original cost estimates should be considered only as the initial baseline and as more knowledge is gained these estimates should be revised and a new substantiated baseline established. This approach should be incorporated into the Selected Acquisition Reports (SARs) used within the Department and by Congress.

Recommendations

The management cost information needed within the Department and for visibility to Congress on major weapon systems acquisitions should be improved by recognizing the evolutionary nature of cost baseline estimates. Estimates should be reevaluated at each significant milestone of development.

Increased use should be made of parametric costing techniques to improve the quality of original and subsequent estimates, and to help offset the difficulties of estimating the cost of unknowns.

Industry Weaknesses

A review of the defense development process would be incomplete without a discussion of the role of industry and its share of the responsibility for the problems within the process.

One serious weakness of industry is the tendency toward overresponsiveness to every expressed or implied desire of Department of Defense personnel. Overresponsiveness should not be substituted for the exercise of responsibility. As a management team member, it is the responsibility of industry to point out to the Department the true nature of acquisitions and developments as seen by industry. For example, the following are areas in which industry has demonstrated an overresponsiveness on specific developments:

(1) Unquestioned acceptance of inefficient and unnecessary management control system requirements and related data items.

(2) Failure to point out the potential risks associated with the inherent technical uncertainties in the development of a specific weapon system.

(3) Overoptimistic cost estimates and, in some cases, unwarranted buy-ins.

(4) Unquestioned acceptance and, in some cases, promotion of overly sophisticated design solutions to satisfy the stated requirements.

Industry has also demonstrated reluctance to have a continuous meaningful dialogue on certain procurements by communicating to the government Program Manager potential major technical, cost or schedule problems as soon as they are first identified.

Another weakness originates in the possible belief by a contractor that he has obtained his contract wholly or in part through political favoritism or pressure; this can seriously undermine the authority of the Program Manager. The degree to which the Program Manager's authority is undermined does not depend on whether or not there was, in fact, a political motivation in the selection of the contractor, but on whether the contractor believes such was the case.

Some existing practices contribute to beliefs by contractors and by the public that political influence can and does affect the selection of contractors. It is and has been customary for the Executive Branch to provide members of the Congress with 24 hours notice of contract awards in their States or Districts, as the case may be, prior to the public announcement of the contract award. Frequently, therefore, contractors and the public learn of the contract award from a Senator or Congressman prior to the public announcement. This gives rise to an inference, however much belied by the facts, that the political officeholder making the announcement of the contract award had some influence on the selection of the contractor.

Potentially, the most serious weakness is the trend of the demonstrated reluctance by industry, whether justified or not, to commit resources to defense business. If this trend continues, the Nation's defense posture will be seriously weakened, as a dedicated industrial capability is essential to maintaining that posture.

Many of the recommendations in this report are specifically addressed to making a substantial improvement in the overall defense procurement environment. Even though the environment is largely controlled by the Government, industry must also assume a more responsible role if the full potential for improvement in the environment is to be realized, and the rising cost of weapon systems stemmed.

Recommendations

Individual contractors should accept a more responsible role as management members of a defense development team, and provide the Government with the benefit of greater objectivity in the contractor's independent evaluation of a proposed development.

The practice of providing the members of the Congress 24-hour advance notice of contract awards should be discontinued. Such members should be notified concurrently with public announcement of contract awards.

Defense Laboratories

The purposes of Defense Laboratories are to: (1) maintain national competence in areas of technology peculiar to military needs; (2) provide a technological capability for quick response to unpredictable needs and opportunity; (3) provide a working interface between military commanders and planners on the one hand and the technological community on the other; and (4) act as advisors in the Defense RDT&E contract program.

Overall, the productivity of Defense in-house laboratories appears low compared to the very substantial investments in them. This is particularly true with respect to Army Laboratories, and those Army Laboratories connected with arsenals appear least productive.

Consolidation of laboratories and centers to achieve a more nearly matched functional alignment with the scope of normal problem areas is very badly needed. Efforts at consolidation are being made, but the rate of progress is far too slow. . . .

The Defense Laboratories and test centers suffer from a rigid personnel system which inhibits qualitative improvements to the technical staffs and fails to promote or move the more competent people into leadership positions. . . .

The Defense Laboratories and test centers, in addition to their in-house work, actually manage about 15 percent of the Defense Research and Development work done on contract. This circumstance presents a conflict-of-interest problem. The laboratories as developers are in competition with private contractors, and are also managers of the contracts under which their competitors operate. There is an inclination on the part of some laboratories to show favor to products "invented here" and to view

very skeptically any products "not invented here." The R&D laboratories are located far down in the organizational structure within organizations which have much broader responsibilities than just R&D. There is no R&D chain of command from bench to the policy level. Consequently, close monitorship to control the "not-invented-here" attitude is impossible.

Recommendations

The Advanced Research Projects Agency (ARPA) and the Defense Test Agency (DTA) should be directed to make a joint review to determine which in-house defense laboratories and test and evaluation centers are essential to research and development needs of the Department with the goal of eliminating the nonessential ones, and consolidating (across Services) the remainder.

A procedure should be authorized by Statute whereby all or a part of the proceeds from the disposal of existing defense laboratories or centers can be used for construction of a new facility or expansion of an existing one which such construction or expansion has been authorized by Congress.

Close attention should be given to the possible advantages of having some of these laboratories and centers government-owned but contractor-operated.

Operational Testing and Evaluation

Everyone seems to agree that Operational Testing and Evaluation (OT&E) is very important; however, there are siginificant differences of opinion as to what it encompasses, what its proper objectives are, and what organization and methods are necessary to accomplish it most effectively.

It has been customary to think of OT&E in terms of physical testing (under various designations such as operational suitability testing, employment testing, service testing, or field experimentation). It is essential to recognize that the primary goal of OT&E is operational evaluation, and that while operational testing is very important it is only one method of evaluation. To be effective, OT&E must be a total process, using all appropriate methods of evaluation, which spans the entire cycle of a system from initial requirement until it is phased out of the operational forces. If OT&E were limited to physical testing, it would lose much of its opportunity to contribute to decisions on whether to produce a system, and would seldom be able even to influence the system's characteristics and capabilities in any major way.

Much OT&E does, however, involve physical testing and, therefore, it is important to distinguish between "functional" testing and "operational" testing.

Functional testing (often called engineering testing) is done to determine how well various systems and materiel meet design and performance contractual specifications—in other words, whether they meet technical requirements.

By and large, functional testing in and for the Department of Defense appears to be well understood and faithfully executed. Serious policy deficiencies are not apparent, and such failures in functional testing as occur can be primarily attributed to lack of technical competence, oversight, or procedural breakdowns. Functional testing is not considered to be a major problem area.

Operational testing, on the other hand, is done to determine to the extent possible whether such systems and materiel can meet operational requirements. It must provide advance knowledge as to what their capabilities and limitations will be when they are subjected to the stresses of the environment for which they were designed (usually combat). Operational testing must take into account the interface with other systems and equipment, tactics and techniques, organizational arrangements, and the human skills and frailties of the eventual users.

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Currently, there is no effective method for conducting OT&E which cuts across Service lines, although in most actual combat environments, the United States must conduct combined operations. The interactions among Services become extremely important during combat, and critical military missions transcend Service boundaries and responsibilities (for example Close Air Support, Reconnaissance, and Air Supply). Because of the lack of joint OT&E, it is not only very difficult to detect certain kinds of deficiencies and to predict combat capability in advance, but it is also difficult to make decisions relating to overall force composition.

Funding throughout the Department of Defense has been and continues to be inadequate to support much necessary OT&E. Also, the funding of OT&E is confused, both at the OSD level and within the individual Services, and neither in OSD nor in any Service is there a single agency responsible for insuring that OT&E is adequately funded. In fact, there is no agency that can even identify the funds that are being spent on OT&E.

Funding within the individual Services differs substantially. In general, however, OT&E funds are difficult to identify because they come from several budget categories such as RDT&E and Operations and Maintenance (O&M). Because funds earmarked for OT&E do not have separate status in the budget, or in program elements, they are often vulnerable to diversion to other purposes.

It seems evident that separate program elements for OT&E must be established within the Services if OT&E is to receive the financial support required, and prohibitions provided against diversion of OT&E funds. Even then, OSD must assume the responsibility of insuring that the Services budget adequately for OT&E.

Recommendations

A separate program category should be established for Test and Evaluation.

The responsibility for overview of Defense test and evaluation effort should be assigned to the Defense Test Agency. In addition, the Agency should be responsible for design or review of test designs, performing or monitoring of tests, and continuous evaluation of the entire test and evaluation program.

Procurement

The complex and dynamic Defense procurement environment and the associated procurement process are characterized by a variety of significant and increasingly serious problems.

Statutory Framework

The basic statute controlling procurement by the Department of Defense, except of land, is the Armed Services Procurement Act of 1947, as amended, now codified and incorporated in Title 10, Chapter 137 of the United States Code.

The Armed Services Procurement Act is at variance with the realities of Defense procurement and adds considerably to the overhead costs of the Department of Defense. The Act stipulates that procurement contracts are to be made by the use of formally advertised contracting methods, but to this general rule the Act provides 17 conditions of exception under which negotiated contracts may be used.

The priorities established by this statute do not reflect the realities of Defense procurement. Actual Department of Defense procurement needs are such that only 10 to 12% of the Defense procurement dollars is spent through the method of formally advertised procurement which is established in the statute as the general rule.

When a contract for procurement of goods or services is negotiated, it must be under the authority of one of the 17 statutory exceptions to the general rule and such actions, as noted, involve 88 to 90% of the dollars involved in Defense procurement actions. When a contract is negotiated, the statute prescribes that the procuring agency must prepare a Determination and Finding (D&F) documenting the conditions and circumstances and justification for utilization of the particular exception to the general rule for procurement. The D&F must be attached to the copy of each negotiated contract, which must be filed with the General Accounting Office. The Determination and Finding is also required by statute to be kept on file in the office of the officer making the D&F for a period of six years.

The consequence of the statutory prescriptions and the D&F requirements place the officers of the Department of Defense in the position of being required to document and explain why they are using the most appropriate procurement method rather than an inappropriate one. The preparation, review, submission and filing of the required D&Fs demand and receive a significant amount of personnel effort including that of the various Secretaries and Assistant Secretaries of each Military Department.

Although the Armed Services Procurement Act is the principal statutory authority for Defense procurement, it is by no means the only statute governing such procurement. There are approximately 40 separate statutes which affect Defense procurement. These statutes cover such diverse matters as budgeting and accounting, small business, freedom of information, assignment of claims, adjudication of claims, limiting contracts to available appropriations, extraordinary contracting authority for national defense needs, degree of finality and judicial review of agency decisions on contracts, performance bonds, renegotiation, labor standards on public contracts, anti-kickback provisions, convict labor, Buy American, conflict-of-interest, and procurement of supplies made by prisoners and the blind.

In certain respects, the procurement laws are dated; that is, they do not take into account legitimate and useful techniques developed and put into use subsequent to the passage of the procurement laws. For instance, the law accords no recognition to the variety of incentive-type contracts which have emerged in recent years.

Armed Services Procurement Regulation

The principal Department of Defense procurement regulation is the Armed Services Procurement Regulation, commonly referred to as "the ASPR," which is to implement the provisions of the Armed Services Procurement Act, other statutes relating to procurement, Executive Orders, Bureau of Budget circulars and, as appropriate, judicial decisions. The provisions of the ASPR are applicable to the procurement of all Department of Defense materiel and services which obligate appropriated funds, except transportation services procured by transportation requests, transportation warrants, bills of lading and similar transportation forms.

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The principal deficiencies with the ASPR are as follows:

1. The ASPR contains a mixture of procurement policies, practices and procedures which obscures procurement policy, making it difficult to identify, interpret and to comply with.

2. The complexity of the ASPR structure is unrealistic in that its provisions and prescribed practices are difficult, if not impossible, to use within the highly stratified organization administering Defense spending programs, particularly in view of the various procurement personnel grade levels responsible for compliance with the ASPR.

3. The ASPR is in a continuous process of change, a fact which impedes the timely processing of procurement actions, and consumes an inordinate and expensive amount of time of the procurement personnel responsibile for compliance with the ASPR.

The ASPR is expanded and supplemented by each Military Department, the Defense Supply Agency and the Defense Contract Audit Agency by means of their separately developed and maintained procurement regulations.

From a substantive standpoint, the ASPR gives minimum emphasis to the need for maintaining an adequate industrial base, although the Armed Services Procurement Act gives policy recognition to this consideration with a specific exception (No. 16) to the general rule requiring advertised bids.

In addition to the complex framework of procurement regulations, there is an abundance of Department of Defense and Military Service directives, instructions, memoranda and other guidance material, including circulars, handbooks and guides, which have a pronounced impact on Defense procurement. These documents deal with organization and management, and administrative policy concepts and procedures. Procurement personnel must be governed in practice by these constraints, as well as by the procurement family of regulations.

The Department of Defense directive and guidance system results in an avalanche of paper instructions which are duplicative, overlapping and some times contradictory. There is no evidence of a concentrated attempt to reduce the number and scope of the directives and guidance, or to make these documents consistent and har-

monious. The need for assessment and review is conspicuous.

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Recommendations

The Secretary of Defense should recommend to the Congress and to the existing commission on Government-wide procurement that the Armed Services Procurement Act and other applicable statutes be amended to reduce or eliminate the requirement for Determination and Findings on all negotiated contracts, to reflect the practicalities of Defense procurement needs and activities which result in most Defense procurements being accomplished by other than formally advertised methods, and also to reflect the various new types of contracts developed in recent years.

The Armed Services Procurement Regulation (ASPR) and the ASPR Committee System should be reviewed with the objective of formulating a more efficient managment organization for incorporating changes into the ASPR and with the view toward reduction in the volume and the complexity of the ASPR.

In the implementation of procurement policy, due regard should be given to the need for an adequate, but not excessive, industrial base.

Improvement should be effected in the acquisition, training and retention of procurement personnel, with emphasis on a promotion system for contract negotiators which will not necessarily remove them from negotiating activities.

Industrial Mobilization Base

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It is imperative that a viable industrial mobilization base be established and maintained. However, it does not now exist under the concept of Department ownership of industrial plants and plant equipment. The Department should reexamine its present holdings and, as a matter of urgency, develop and implement a plan to assure that emergency production of high priority war materiel can be initiated quickly and effectively. This can be achieved in many cases only by maintaining an active production life.

The Department continues to buy plant equipment and provide it to contractors on the theory that it is cheaper to maintain ownership of the equipment than to allow the contractors to charge it off to the contracts.

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Adequate information is not available to determine the full costs to the Department of maintaining ownership of industrial plant equipment; to procure, provide to a contractor for a specific contract, reclaim and store at the end of the contract, and maintain inventory records to permit its reuse when needed. However, it is apparent that the Department is not doing an effective or economical job under the present concept.

Recommendations

The Department of Defense should consider buying and providing industrial plants and equipment to contractors only when it can be clearly shown to be to the economic advantage of the Government or when it is essential to the Department's plan to provide a viable industrial mobilization base. Contractors should be encouraged to provide necessary industrial plants and plant equipment, and should be permitted to charge off peculiar plant equipment against specific contracts.

A program should be initiated for the Department of Defense to divest all plant equipment where ownership cannot clearly be shown to be to the economic advantage of the Government.

A plan should be developed and implemented to assure that emergency production of high priority war materiel can be initiated quickly and effectively.

The responsibility for maintaining an inventory and control of Department-owned equipment should be assigned to the Assistant Secretary of Defense (Installations and Procurement).

Logistics

It is clear that significant military logistics improvement can be achieved through efficient, coordinated exploitation of new technologies in the areas of transportation, communications, automatic data processing (ADP), and Integrated Procurement Management. To date, however, the full potential of these new technologies has not been realized, nor will they be realized in long-range logistics programs that are presently proposed by most of the Military Services.

Supply, Maintenance and Transportation

The potential for increased efficiency and improved effectiveness by standardizing or integrating logistics management and activities has long been recognized. Efficient, coordinated exploitation of new technologies in the areas of transportation, communications and automatic data processing offer increasing rewards in effectiveness of logistics support and cost savings.

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Because the impact of logistics integration has fallen primarily on the procurement and initial inventory management phases, the resulting improvements in effectiveness of support of Unified Commands in the field have been minimal compared to the improvements which are possible. The benefits of standardized and integrated logistics have not been extended overseas to any appreciable extent. Defense Supply Agency responsibilities do not extend overseas. Overseas logistics management is currently the responsibility of four organizational units,—one in each Service—each of which has many elements. Because of inherent and continuing differences among these organizations, the Unified Commander must accommodate different terminologies, different measures of logistics performances and, most unfortunately, different degrees of readiness.

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There is a close interrelationship between the degree of logistics integration and the use of automatic data processing.

Automatic Data Processing. A distinguishing mark of the decentralized and fragmented supply system in the Defense Department is the proliferation of Automatic Data Processing (ADP) systems and programs which are largely incompatible, both intra-Service and inter-Service. This results not only in weaknesses in inventory management and distribution imbalances, but in high and increasing costs of ADP software for a variety

of ADP programs to accomplish the same types of functions. The aggregate costs—and confusion—resulting from the development and periodic upgrading, as advanced computers are required and acquired, of ADP programs for each class of supplies by the DSA, the four Military Services and the theater logistics commands, with minimal compatibility, critically impact on the Department's effectiveness, efficiency and economy. The long-range logistics programs under consideration by most of the Military Services will not remedy this problem.

Maintenance. Maintenance is the ultimate consumer of all technical supplies and materials acquired by the Department of Defense for support of military hardware—a consumption which amounts to approximately five billion dollars annually. Investment in industrial tooling, equipment and facility capability to support this maintenance function accounts for approximately another one billion dollars annually. About one-third of all Department of Defense personnel are involved in the maintenance function.

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Transportation. All of the Services have extensive organic[4] transportation resources, and each of the Military Departments is the "single Manager" for some "common user" transportation service.

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The "common user" activities are the Military Airlift Command (MAC), for which the Air Force is Executive Agent; the Military Sea Transportation Service (MSTS), for which the Navy is Executive Agent; and the Military Traffic Management and Terminal Service (MTMTS), for which the Army is Executive Agent.

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In summary, the logistics system of the Department of Defense is decentralized and fragmented in functional assignment. However, this is not critical in such activities as procurement and the initial warehousing phase (excluding a part of wholesale supply, retail supply, maintenance, traffic management and transportation). Efforts of the Congress and the Office of the Secretary of Defense to improve efficiency and effectiveness of the other activities through standardization of procedures and approaches have achieved very limited improvements. As a consequence, the current inventory management, distribution, maintenance, and transportation systems are needlessly inefficient and wasteful, and even more important, fall far short of the potential for effectiveness of support of combatant commanders.

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Integration of supply, maintenance and transportation functions for the support of Unified and Specified Commands can substantially improve the effectiveness of logistics support while at the same time achieving greater efficiency and economy. A unified vertically-oriented supply and transportation system, including maintenance, should be organized for support of all combat forces, both those overseas and those held in the United States ready for oversea deployment. With a vertical system, integrated from Continental United States through theater management, items could be moved from the United States to overseas commands without financial transactions, and as easily withdrawn in necessary redistribution actions, since supplies in the United States and all theaters, within a given supply class, would all be accounted for within the same stock fund or working capital fund.

Effective logistics integration will require an advanced computerized control and information system, without which the resultant system would be that of a confederation with subdivisions so loosely connected that few of the benefits of union could be achieved. There are significant disparities among the levels of sophistication of ADP systems the Services have achieved to date. The Air Force, with experience at a relatively high level of technical sophistication, has planned a highly advanced systems concept for the 1970s. The Navy, with a wholesale control system in some ways more advanced than the system the Air Force seeks to replace, is designing an advanced logistics system. With reasonable effort, these systems can be brought together. The Army, however, is in the process of implementing a system that is in some ways less advanced than the one the Air Force seeks to replace. In developing a logistics ADP system with common elements for all Services for those functions to be shared, the first step is to stop all current development and procurement activity not necessary for support of near-term operations. In view of the practical problems connected with an integration of these logistics functions, a phased approach is clearly necessary.

Recommendations

The responsibility for providing supply distribution, maintenance and transportation services to the combatant forces in Unified and Specified Commands under the Strategic and Tactical Commands should be assigned to the unified Logistics Command.

The Logistics Command should be assigned the traffic management and terminal management functions now allocated to the Military Traffic Management and Terminal Service (MTMTS), the Military Sea Transportation Service (MSTS) and the Theater Traffic Management agencies.

The Military Airlift Command and Military Sea Transportation Command both should be assigned to the Logistics Command.

The Logistics Command should be directed to develop, under the policy guidance of the Assistant Secretary of Defense (Telecommunications), an ADP logistics system to encompass supply distribution elements that can be shared among the Services, and all development and procurement activity toward separate ADP logistics systems not essential to support of near-term operations should be suspended.

[4] *Assigned as integral equipment of the using command.*

Management and Procedures

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Development Concept Paper

A second major process by which allocation of resources is managed is the Development Concept Paper (DCP), although the DCP is also used for management in the utilization phase.

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When applied to major systems, the DCP has many advantages as a management tool. For general effective use in this area, however, it will require the acquisition and training of personnel in the preparation of DCPs, in order to attain an acceptable standard of quality, which does not now appear to exist. The DCP will continue to be only a tool for management and its limitations should be recognized. Potentially, it could foster an ad hoc management approach for each major development, which could obscure the necessity for structuring and maintaining an overall organization which is effective and efficient. It can also foster a tendency to establish a direct reporting relationship between Program managers and senior decision makers in OSD in each individual case, that, in the aggregate, can overtax the feasible span of control of the senior decision makers.

The application of the DCP format and procedure to research and development areas beyond major system developments portends a degree and span of centralized control by Defense Research and Engineering which is infeasible for efficient management. Major developments have such significant cost consequences that decisions must be reserved to the Secretary of Defense; decisions on lesser programs can more safely be delegated if organization is structured so as to permit precise designation of accountability and maintenance of visibility. Program approval and review can be managed through effective use of the Planning, Programming, and Budgeting System (PPBS). Extension of the DCP process beyond major system developments could seriously overlap the management potential of the PPBS and result not only in needless duplication, but also in overmanagement at top levels.

Recommendations

The Development Concept Paper should not be employed as a management tool for areas of research and development other than major systems developments.

Selected Acquisition Report

The Selected Acquisition Report (SAR) system is a management tool for reporting in detail the original and current estimates of program costs, schedule and performance to top management, and for measuring changes in these factors. The SAR is applied to major development systems.

Efforts are in progress to collect actual contractor costs through the Bureau of the Budget approved Cost Performance Report, to be used in connection with SARs. To date, efforts to collect accurate data for the SARs have reportedly not been very successful.

The basic approach to the SAR is the establishment of a baseline of estimated costs, schedules and technical performance, and the subsequent measurement of the present status against this baseline. Unfortunately, both in concept and in actual practice, baseline reporting in the SAR has led to distorted and unreal use of figures, and a misplacement of management emphasis.[5]

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The SAR approach ascribes an importance and prophetic accuracy to estimates that simply do not exist. Estimates must be recognized for what they often are—educated guesses as to what the future holds. The SAR has tended to shift the objective from that of producing the best possible weapon to that of maintaining a set cost and schedule regardless of what experience and later events show to have been the wisest course.[6]

[5] *See Cost Estimating Section, page 30.*

[6] *See Recommendation following Cost Estimating Section on page 31.*

Recommendation

The Selected Acquisition Reports in their present formats should no longer be used as management tools.

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Telecommunications

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Office of the Secretary of Defense and the Joint Chiefs of Staff. Overall policy guidance and management of telecommunications matters is now widely diffused throughout several elements of the OSD staff, largely as a result of the functional design of the organization.

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At best, the fragmented responsibilities in the Office of the Secretary of Defense generate difficulty in coordinating all of the individual considerations which may arise in an issue, even on such an issue as a discrete weapon system. The problem is greatly magnified when dealing with a commodity or service such as telecommunications which, by the nature of its universality throughout the Department requires corporate management to optimize costs and mission effectiveness.

Within the Joint Chiefs of Staff (JCS), as within OSD, the responsibility for the overview of telecommunications matters is fragmented throughout several functional offices. And, of course, the Director of DCA reports through the JCS to the Secretary of Defense.

Research and Development (R&D). The basic responsibility for R&D efforts lies with the Director of Defense Research and Engineering (DDR&E). The Director of the Defense Communications Agency (DCA) exercises management direction over those R&D activities of the Military Departments which directly relate to the Defense Communications System (DCS). The Military Departments directly manage all other R&D efforts under the guidance of DDR&E. The R&D is either carried out in the Defense laboratories, or under contracts generally administered by them.

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Management

The most obvious weakness of the organization structure is the absence of unitary management at the top

level to assure effectiveness and efficiency from an overall Department of Defense mission point of view, rather than from an individual Military Department's point of view.

OSD is the only level of the management structure with overall Department of Defense perspective which can be given sufficient authority to assure appropriate standardization, compatibility and inter-operability among DCA and the Military Department elements of telecommunications, while protecting the integrity of the mission requirements of the individual combat, contingency and support commands. It is the only level in a position to objectively balance mission capability and cost. This level should be restructured, and staffed with appropriate expertise to provide effective staff management from a total Department of Defense point of view of (1) all telecommunications resources and (2) all operations and engineering matters relating to telecommunications.

In June 1970, a position of Assistant to the Secretary of Defense (Telecommunications) was established. This ATSD(T) was assigned broad, consolidated functions and responsibilities in the telecommunications area in response to the problems created by the lack of single management from the OSD level. The responsibilities assigned to the ATSD(T) are consistent with the conclusion of the Panel.

Recommendations

The responsibility for defense telecommunication activities should be under the staff supervision of the Assistant Secretary of Defense (Telecommunications). The Assistant Secretary of Defense (Telecommunications) should be directed to review all defense communications activities with the goal of eliminating inefficient duplication; specifically, for example, those telecommunications activities of the existing Air Defense Command (ADC) which can be effectively merged into other telecommunications operating activities of the Military Departments. The Assistant Secretary of Defense (Telecommunications) should also be directed to assure that each major element of the telecommunications community in the Department generates professionally planned and managed education, training and career development programs for its engineers, researchers and managers, both civilian and military.

The responsibility for all existing and future defense long-haul transmission systems, regardless of their current or intended use, should be assigned to the Defense Communications Agency as part of the Defense Communications System, except those vehicular and air transportable types when held as contingencies or while in temporary deployment for active combat support. In addition, the Defense Communications System (DCS) should be redefined so as to include base, post, camp and station telecommunications in the United States and garrison (permanent) type installations overseas. The DCA should also be assigned the fiscal control of DCS elements. The communications and electronics officers of the Unified Commands should be under the operational and technical supervision of the Defense Communications Agency.

The Air Force Ground Electronics Engineering Installation Agency (GEEIA) and the telecommunications activities of the Strategic Air Command (SAC) should be merged into the Air Force Communications Service (AFCS).

Automatic Data Processing

During the next decade, computer systems will undoubtedly continue to develop at a rapid rate. It is anticipated that the larger computer systems in 1980 will have as much as 100 times the capacity of the largest system today, and that the medium-scale computer, which is the backbone of the Defense Department's system today, will be substantially replaced by a combination of the new, larger computers and small, desk-type computers.

Another major change will result from telecommunications between computer and computer users. Indications are that most computers will be on-line with teleprocessing capability by 1980. At the present time, the majority of the Department's computers cannot be used in this mode.

The challenge which the Department continues to face is that of design and development of standard Department-wide ADP systems. The history of ADP development clearly shows the need for and benefit of progressive standardization, at least for compatibility. Standard systems were first introduced at the Command level, and were followed by the development of Service-wide systems. Today's primary challenge is at the Department of Defense level.

For example, at the present time, the Army is developing a system which encompasses the Army Logistics Command function. The Air Force is currently working on an Advanced Logistics System, which performs the same functions as the Army system. The Navy is planning a redesign and updating of their Uniform Automatic Data Processing System, which supports their key logistics functions. Many of the modules of these systems perform almost identical functions, such as warehousing, shipping and receiving, inventory control, etc. Software programming for each of these is costly and each independent modernization step taken on the many separate programs involves unnecessary duplication and appears to lock in more tightly the incompatibilities of the various systems. This same observation applies to other functional areas, such as personnel management systems and base level management.

Hardware and Software System Design Capability

The Department is almost completely dependent on hardware manufacturers for system design[7] for hardware and software. Those individuals within the Department who are competent in system design are scattered among the various components of the Department and their efforts are directed primarily to other activities such as development of application programs or information systems. The lack of in-house system design capability necessitates placing a substan-

[7] *Systems Design—Hardware. This activity includes the design of the overall computer hardware system. This design consists mainly of the selection among equipment available from commercial suppliers including independent peripheral manufacturers. This activity will establish the necessary interfaces required to interconnect the equipment available from*

tial load of system design work on potential vendors as a condition of responding to Requests for Proposals. This condition has a tendency to limit response to the larger suppliers, and, even within this group, to those suppliers who assess their competitive position as being very high. The net effect inhibits competition for hardware procurements.

The lack of an in-house capability for hardware system design deprives the Department of the potential for improved efficiency and lower costs to be obtained from selection among separately priced elements of a computer system available from commercial suppliers, including independent peripheral manufacturers. This lack of capability also prevents the Department from promoting a higher degree of separate pricing and increased competition through the development by manufacturers of hardware elements with a broader interface capability. The potential losses from this lack of in-house capability will increase as the unbundling trend in the private sector continues. It is becoming increasingly important for the Department to have a capability to develop interface standards. In the continued absence of such a capability, the Department will be unable to keep its ADP policy sufficiently flexible to anticipate and take advantage of continuing changes in the ADP field.

There is no significant software systems design capability in the Department. Such capability as exists is widely dispersed and focused on narrow spectrums, usually tied to specific applications. As a consequence, no effective mechanism exists for development of more flexible languages, compilers, executive monitors, data storage and retrieval software, operating systems, translators and liberation programs, etc. Current practice makes the Department highly dependent on hardware manufacturers for design of systems software. The manufacturers have no incentive to provide increased flexibility to the Department which might increase the Department's independence of the supplier's particular machine and increase Department-wide compatibility of ADP programs.

different suppliers. It is not anticipated that the Department will design its own hardware.

Systems Design — Software. This activity includes the design of basic systems software; i.e., Compilers, Executive monitors, Data Storage and retrieval software, "liberation programs," etc. It does not include applications programs or information systems.

In-House Capability. In-House capability to perform a function or task does not necessarily mean that the work be totally performed by Department employees but that some of the Department's employees must be able to perform the task. Where work is contracted to outside sources, the Department must have sufficient depth to evaluate the work of the contractor and make selections among alternatives.

Justification and Selection of ADP Equipment

The justification and selection of computers by the Department of Defense is controlled by procedures intended to assure that the computer is used for beneficial applications, and that the selection process provides the necessary capability at the lowest cost and promotes competition between vendors. The Assistant Secretary of Defense (Comptroller) and each of the Military Departments has prepared documents which establish these procedures.

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A major difficulty involved in the justification and selection process is the time required to complete the process and the difficulty of predicting the workload with sufficient accuracy to select the ADP system which most adequately meets the requirements over the life span of the equipment. The vast majority of estimates are lower than the actual workload by the time the system is operational, and this causes the system to be too small to perform all the required functions.

Perhaps the most serious flaw is that all this work is done to determine the best computer system for one particular process. If a broader approach were taken, an entirely different computer system might be able to accomplish that process and many others also on a more efficient basis at no increase in cost.

In many cases, the selection is made by personnel who have no first-hand knowledge of the workload, but depend entirely on the description of the applications.

This process has caused the Department some difficulties in the past, and in several cases the computer equipment selected by this process has been too small to carry the workload for even the first year. There is general agreement among Department personnel that the procedures are too complex and time consuming, and limit competition between vendors.

The elapsed time between the preparation of the first documentation describing a computer requirement and the installation of the equipment varies between a minimum of two years and a maximum of six or more years. This time is used in the preparation of the justification documents, the system specifications, soliciting bids from vendors, evaluating proposals from vendors, and obtaining equipment. Often it is necessary to repeat one or more of these steps.

The computer workload is a dynamic and changing requirement and often by the time the computer has been installed, the workload is much larger and significantly different from the one anticipated at the time the computer procurement began. The time required to change the documentation is almost as long as the initial preparation. Therefore, often the requirement is not updated during the procurement cycle and the system effectiveness may not be as high as it could have been. If the Department is to have effective and efficient computer support of its missions, the time delays in obtaining computer support must be greatly reduced.

The current procedures result in major inefficiencies within the Department. The long delay times in obtaining new or replacement equipment result in equipment being kept long beyond its useful life. The determination of useful life should be based on the cost of performing work on the equipment, not on the age of the equipment.

Another major effect of the present procedures is the installation of several small and medium scale comput-

ers in the same geographical area. There are several locations which have over 50 computers. These multiple computers can result in costs which are as much as five times larger than would be necessary if a few large computers were used in a shared time operating mode.

If the Department had a system design capability, as previously discussed, the requirement for equipment could be stated in terms of the equipment's performance characteristics, rather than the specific planned application. The justification would be of the system, not of the individual equipment acquisitions, and the system could include many specific applications by today's terms.

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Recommendations

The responsibility for defense automatic data processing should be under the staff supervision of the Assistant Secretary of Defense (Telecommunications). The Assistant Secretary of Defense (Telecommunications) should: (a) take the necessary steps to enable the Department to develop an in-house capability for ADP hardware systems and software systems design needed for proper management; (b) review proposed ADP activities and monitor and evaluate on-going activities with respect to effectiveness of the utilization of resources; (c) test through model programs the feasibility of computer services/centers which could standardize and centralize the ADP system by functions (such as the major Commands) and/or geographically, with the intent of determining both short- and long-range ADP capability objectives; and (d) develop a training program for ADP specialists and a career plan for ADP personnel.

The procedures governing the justification and selection of computers should be revised to require a statement of ADP equipment capability as opposed to specification of intended application of the equipment.

Contract Studies

The purpose of contract studies is to provide a capability to the Department of Defense which is not available internally, either because it requires scarce or special skills required infrequently in any Departmental organizational element, or because independence and objectivity are a special concern. Those organizations who regularly provide contract studies frequently provide a transmission belt for ideas and information across the echelons of defense organizations.

Accurate information on the nature and extent of contract studies within the Department is difficult and often impossible to obtain. Large numbers of contract studies are performed for various elements of the Department of Defense by both profit making and not-for-profit private research organizations. There are, however, no central records of the studies that are done. . . .

There is no effective control of contract studies within the Department. While each study must be justified to get funding, there does not appear to be, at any point, an effective mechanism for establishing a relative need for the study, or for determining the extent to which the subject area has been studied previously. It appears from reviewing completed studies that many of them are not objective analyses to provide inputs to the decision process, but are rather performed to support positions known to be held by the contracting organizations.

The procedures used by the Department of Defense to contract for studies do not provide adequate safeguards to assure that the Department receives value for its expenditures. A study contract does not generally contain a stipulation as to the quality of the study to be made. The organization that wants to contract for a study works with a contracting officer, usually not a part of the organizational element wanting the study, and provides the information and justification required for the contracting. After the contract is let, the element for which the study is being done provides a technical representative who represents the contracting organization in the substantive areas of the contract study. The contracting officer and the technical representative frequently have little communication after the contract is let. The technical representative often is not consulted before periodic payments are made to the contractor. Most technical representatives are not familiar with contracting procedures, and even if they see that the contractor is not performing and will not produce a satisfactory product, they do not know what to do to protect the Department's investment.

Contracts for analytical studies tend to be let on the same basis as hardware production contracts. There is considerable evidence that they experience many of the same problems. The low bidder is not always the best equipped to make the desired analysis. One major requirement should always be an objective analysis, but often contracts are let to contractors who have a direct interest in the outcome. By bidding low, they buy information which is used to obtain an advantage in a subsequent competition for hardware or software production. The contracting officers make too little use of their authority to exclude study contractors from subsequent production contracts.

The Federal Contract Research Centers (FCRCs) are a group of special nonprofit organizations created during and since World War II. Each has a special relationship with some agency of the Federal Government. . . .

There is little doubt that each FCRC was, when created, the most effective or expedient means of providing certain required capabilities to the Department of Defense. However, both the needs of the Department and the character of some of the FCRCs have changed substantially. The Panel believes that this is an appropriate time to reassess the special relationship of each FCRC and its Departmental sponsor.

Recommendations

The Secretary of Defense should delegate to the Deputy Secretary for Evaluation the authority to establish and enforce Department of Defense policies and procedures which make it possible to account for all contract studies to reduce duplication, assure relevance, and enhance quality. Specifically, the Deputy Secretary for Evaluation should:

(a) Establish procedures to review and validate requirements for contract studies.

(b) Establish a central control record of contract studies to include

subject, purpose, cost, significant findings and an assessment of the quality of the work and the utility of the product.

(c) Establish procedures for contracting for studies to provide adequate safeguards to assure that the Department gets a product that is relevant and responsive to the requirement; assure a close working relationship between the contracting officer and the technical representative; and develop criteria for selecting contractors that will assure competent and objective support to the Department.

(d) Review each Federal Contract Research Center sponsored by the Department of Defense to determine on an individual basis which should be continued with substantially their present form and mission, which should undergo significant changes, and whether any may have outlived their usefulness as FCRCs. The study should also develop the means to make collective FCRC capabilities more widely available to Department of Defense sponsors.

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Equal Employment Opportunity Compliance in Defense Contracts

Executive Order (EO) 11246, "Equal Employment Opportunity," was issued on 24 September 1965 and amended by EO 11375 in October 1967. Among its provisions are regulations (Part II) which require that government contractors and subcontractors take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex or national origin. This obligation applies to the entire company, and not just to the facility involved with the specifically contracted item.

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The aspect of the Department's Contracts Compliance program which causes the most concern is the apparent conflict of the Equal Employment Opportunity and the procurement missions within Defense Contract Administration Services (DCAS). Procurement officers appear to view the contract compliance requirement as a hindrance in performing their primary procurement function. Since the contracts compliance program is essentially an audit function, the apparent conflict seems to be in the fact that the procurement people are auditing themselves. This conflict could be reduced by relieving the procurement people of the potential trade-off decision which might compromise the Equal Employment Opportunity requirements.

There are additional means, of course, of advancing the general objectives which underlie the Equal Employment Opportunity Contracts Compliance Order. There should be equal opportunity for employment for all races by contractors producing for the Department of Defense, but it is just as important that all persons have an equal opportunity, regardless of race, to be employers who contract with the Department of Defense. Procurement policies should not show preference to prospective contractors either on the basis of race, size or age of the prospective contractor as a business entity, among those capable of performing the needed service or supplying the needed materiel.

Recommendations

The Equal Employment Opportunity policy direction and guidance responsibility within the Defense Department should be under the staff supervision of the Deputy Secretary for Evaluation. A restudy and clarification of the requirement of the Office of Federal Contract Compliance and the penalties for noncompliance for the guidance of the Defense Contract Audit Agency and Defense Contractors should be obtained.

The implementation of the contract compliance program within the Defense Department should be assigned to the Defense Contract Audit Agency (DCAA). In order to fulfill its assigned annual review of contractors' facilities, additional professional and clerical personnel should be assigned to DCAA.

Procurement policies should be so formulated as to insure that there is no impediment to participation by prospective contractors with the capability to perform, regardless of the race or size of the prospective contractor, or the period which the prospective contractor has been in business.

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Industrial Relations

The labor and union-relations policies of the Department of Defense, both as to its own employees and its relations with the policies of employers with whom the Department has procurement or other contracts, are determined primarily by the policies applicable to the entire Executive Department of the Federal Government.

As this is such a vast field, and as it is not peculiar to the Department of Defense, the Panel did not study it in depth. However, to present a rounded picture, a few comments seem called for.

First, it is obvious that the Department of Defense could not operate efficiently without the whole-hearted cooperation of its own employees and the employees of its contractors. It must also do its part to maintain good relations with unions, whether they represent their own employees, employees of their contractors, or other employees whose cooperation is essential to the operations of the Department—such as transportation and construction workers.

Second, the Department of Defense is involved in such a large percentage of the contracts entered into by the Federal Government that the Department's actions and attitudes have an important bearing on the relationships with labor of the Government as a whole. If it wants the cooperation of labor—working people and their unions—as it must, it is necessary, in turn, for it to be sensitive to the attitudes of labor.

Third, while the Department of Defense must operate under the terms of legislative mandates, executive orders of the President, rulings of the Comptroller General and others, it has the responsibility to point out to the appropriate authority any circumstances which seem to call for changes in existing procedures.

Recommendation

The Department of Defense, although not expected to act as enforcement agency of national labor laws, should support any appropriate action that would permit more flexibility in such matters, so that contracts could be withheld from companies that have been determined by appropriate authority to have flagrantly, deliber-

ately, and repeatedly violated expressed national labor policy. At the same time, the Department should not use its contracting powers to help or hurt any party involved in a union representation question, a collective bargaining agreement, or an inter-union dispute.

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Military Industrial Complex

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The Panel has not been asked to examine the level of military expenditures, nor is it qualified by composition or study to offer advice on this critical matter, but we believe it is our responsibility to comment on other interfaces between the Department of Defense and defense industry that have given rise to concern, namely: (1) the need for effective civilian control; (2) the size of profits under defense contracts; and (3) conflicts of interest.

(1) The most important of these is the need for effective civilian control, so that any tendency of a "military-industrial complex" to expand beyond the levels necessary for the security of the country can and will, in fact, be curbed. The recommendations in this Report considered this concern and were aimed at reassuring that the decision-making powers are in the hands of the duly constituted civil authorities in the Legislative and Executive Branches of the Federal Government.

(2) Concern with the military-industrial complex often appears to be founded on a belief that defense contractors make large profits, and that the desire for profits leads them to press for ever larger defense budgets.

Some years ago, there were instances of excessive profits on defense contracts. However, the rate of profits has been declining and there are now instances where profits are abnormally low or non-existent. In recent years, the only conclusion that can be reached from available evidence is that no charge of generally excessive profitability can be supported. Furthermore, renegotiation requirements applicable to defense contracts afford reasonable protection against possible excessive profits.

Profits, which constitute the principal incentive for industrial organizations, cannot be effectively adjusted to influence the level of competition for defense business by an approach based only on the average profits of large contractors or small contractors. The approach must deal both with the level of profits for all industry necessary to compete for capital, and the level of profits in each particular industrial field.

To formulate such a policy will not be easy; but the attainment of the objective can never be reached unless the first step is taken, which is to make the adjustment of incentives for industry to compete for defense business a continuing consideration in forming overall defense policy. In addition, of course, there must be careful monitoring of the profit level on individual contracts to make sure that the levels are not generally higher than necessary to attract the number of contractors, large and small, needed to fulfill the requirements.

To keep the whole subject in perspective, it is important to note that the amounts paid for research, development, and procurement are large in dollars, but still represent only a portion of the total defense budget. Even within this portion, profits are a relatively small proportion of the costs—less than 10%. Too much attention to profits can divert attention from the much larger elements of costs, quality, and performance. Costs other than profits can vary much more than the entire amount of defense profits, depending on the productivity of defense contractors and the effectiveness of their management and of the management of the Department of Defense. Implementation of the recommendations made in these latter areas can, it is believed, result in large savings over a period of years, and at the same time produce improvements in quality and performance.

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STRATCOM Forms CEEIA

The Army Strategic Communications Command (STRATCOM) has announced the formation of a subordinate command, the Communications-Electronics Engineering Installation Agency (CEEIA). CEEIA will provide centralized management and control of STRATCOM's global communications-electronics engineering and installation activities.

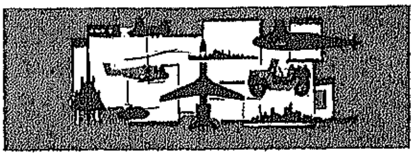
A–SCAN Permits Low Visibility Aircraft Landings

A helicopter landing guidance signal system is under development and test by the Army Electronics Command's Avionics Laboratory, Fort Monmouth, N.J. Called A-SCAN, the purpose of the system is to enable safer low visibility landings in small areas.

The airborne portion of A-SCAN includes a radio receiver and a transmitter for interrogating distance measuring equipment. The receiver includes a data processor to make the computations required for the final information outputs to the pilot.

The system uses three ground based units. A localizer guidance unit transmits microwave signals in a lateral sweep across the desired sector. One of two needles on a course deviation indicator in the cockpit tells the pilot when he is on the right horizontal approach path. A glide slope guidance unit "fires" radio signals over a vertical sector to establish the reference for the descent path. Derived data is indicated on the deviation indicator by a second needle, and shows the pilot his position in respect to the desired descent path. If the aircraft is approaching the landing site below the minimum safe angle, the pilot is warned by an alarm, such as a flashing light or a buzz. The third ground based unit is distance measuring equipment which tells the pilot how far he is from the landing site. The airborne transmitter sends signals to the distance measuring equipment, which sends them back to the aircraft. The time interval between the transmission and reception of the signals aboard the aircraft determines distance.

The A-SCAN system is capable of providing reliable course guidance with approach angles up to 15 degrees or more, contrasting with conventional 2- or 3-degree systems. Because the pilot can select the desired glide slope, the A-SCAN system can also be used with fixed wing aircraft.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of July 1970.

DEFENSE SUPPLY AGENCY

2—The Defense Personnel Support Center, Philadelphia, Pa., issued the following contract for men's wool gabardine overcoats:
Abate Clothing, Inc., Atlantic City, N.J. $1,201,783. 47,008. DSA 100-71-C-001.
Pembroke, Inc., Egg Harbor City, N.J. $3,544,500. 150,000. DSA 100-71-C-0002.
—Shell Oil Co., New York, N.Y. $1,704,003. JP-4, Com Jet A-1, 115/145, 100/130 and and MIL-L-22851A Type II fuels, and defueling and reservicing aircraft at various Eastern and Midwest airports. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1738.
—The City of El Paso—International Airport, Tex. $1,412,420. JP-4, Com Jet A-1, 115/145, MIL-L-22851A Type II fuels, defueling and reservicing. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-1751.
—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for various quantities of fuel oil and gasoline for use in Delaware, the District of Columbia, Indiana, Kentucky, Maryland, Ohio, Tennessee, Virginia and West Virginia:
Texaco, Inc., Long Island City, N.Y. $1,580,844. DSA 600-70-D-2130.
Sun Oil Co., Philadelphia, Pa. $1,027,-763. DSA 600-70-D-2127.
Shell Oil Co., New York, N.Y. $1,119,-953. DSA 600-70-D-2121.
Mobil Oil Corp., New York, N.Y. $1,-572,665. DSA 600-70-D-2107.
Gulf Oil Corp., Houston, Tex. $3,598,-868. DSA 600-70-D-2097.
American Oil Co., Chicago, Ill. $1,887,-792. DSA 600-70-D-2071.
7—John R. Hollongsworth Co., Phoenixville, Pa. $1,485,015. 1,990 generator sets. Defense General Supply Center, Richmond, Va. DSA 400-70-C-6287.
10—Lester D. Lawson and Co., Long Beach, Calif. $2,098,311. 122,208 ration supplement sundries pack cases. Dowell and Co., Modesto, Calif. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-71-C-B001.
16—The Defense Personnel Support Center, Philadelphia, Pa., awarded the following contracts:
Blue Star Foods, Inc., Council Bluffs, Iowa. $1,624,832. 2,188,661 5½ oz. cans of beef with spiced sauce and 2,650,080 5½ oz. cans of beef steak. DSA 13H-71-C-Z028.
Oregon Freeze Dry Food, Inc., Albany, Ore. $1,827,495. Freeze dry components for 2,640,064 long range patrol food packets. DSA 13H-71-C-Z027.
17—Tony Downs Foods Co., St. James, Minn. $1,108,466. 2,949,120 11½ oz. cans of beef slices and potatoes with gravy. Madella, Minn. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-71-C-Z024.
—Waller Petroleum Co., Inc., Baltimore, Md. $3,476,575. Various quantities of oil and gasoline for use in Mid-Atlantic states. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-2135.
20—Richard Wynn Enterprises, Inc., Knoxville, Tenn. $1,474,382. 822,000 Navy light blue utility jumpers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0024.
21—Putnam Mills Corp., New York, N.Y. $1,029,212. 1,185,000 linear yards of water repellent mildew resistant cotton duck cloth. Marion, N.C., and Spartanburg, S.C. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0085.
—Gibraltor Fabrics, Inc., Brooklyn, N.Y. $1,822,712. 277,008 ponchos. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C1-0090.
23—Atlantic Richfield Co., Philadelphia, Pa. $1,258,362. Petroleum products. Defense Fuel Supply Center, Alexandria, Va. DSA 600-71-D-0002.
24—Rock River Woolen Mills, Brownwood, Tex. $1,424,032. 240,000 moth-proofed wool bed blankets. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0104.
27—Union Oil Co. of Boston, Revere, Mass. $1,518,637. Petroleum products for use the New England area. Defense Fuel Supply Center, Alexandria, Va. DSA 600-71-D-0117.
28—International Paper Co., New York, N.Y. $1,028,523. 2,879,914 fiberboard boxes with sleeves. Georgetown, S.C., and San Jose, Calif. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H-71-C-Z045.
29—Gibraltor Fabrics, Inc., Brooklyn, N.Y. $1,822,712 (contract modification). 277,008 ponchos. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0090.
31—Dow Chemical Co., Midland, Mich. $1,-201,051. 154,458 gallons of White defoliant for the Air Force. Defense General Supply Center, Richmond, Va. DSA 400-71-D-0028.
—American Oil Co., Chicago, Ill. $1,038,860. 8,375,000 gallons of No. 2 fuel oil for the Army and Air Force. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-2071.

CONTRACT LEGEND
Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

DEPARTMENT OF THE ARMY

1—Union Carbide Corp., New York, N.Y. $2,-442,731. 500,000 batteries. Charlotte, N.C. Army Electronics Command, Philadelphia, Pa. DA-AB05-71-C-4311.
—Page Aircraft Maintenance, Inc., Fort Rucker, Ala. $27,500,510 (contract modification). Maintenance of 1,100 rotary and fixed wing aircraft at Fort Rucker and Fort Stewart, Ga. Contracting and Purchasing Office, Fort Rucker, Ala. DA-BC01-69-C-0003.
—Western Electric Co., New York, N.Y. $2,186,051 (contract modification). Training coordination and planning in key personnel courses, Greensboro, N.C. Army Safeguard System Command, Huntsville, Ala. DA-HC60-69-C-0010.
2—RCA, Moorestown, N.J. $3,118,310 (contract modification). Two mobile MPS-36 radar instrumentations. White Sands Missile Range, N.M. DA-AD07-68-C-0015.
—Philco-Ford Corp., Palo Alto, Calif. $1,750,000. Upgrade two satellite communications stations. Camp Roberts, Calif., and Fort Dix, N.J. Army San Francisco Procurement Agency, Oakland, Calif. DA-AG05-70-C-0929.
6—URS Systems Corp., San Mateo, Calif. $1,797,586. Technical service and operations for data processing softwear (combat service support). Fort Hood, Tex., and Falls Church, Va. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-71-C-0001.
8—American Dredging Co., Philadelphia, Pa. $1,598,758. Dredging in Newark Bay adjacent to Elizabeth, N.J. Army Engineer District, New York, N.Y. DA-CW51-71-C-0003.
9—Connolly-Pacific Co., Long Beach, Calif. $2,388,500. Construction of a detached breakwater off the entrance to Ventura Marina, Calif. Army Engineer District, Los Angeles, Calif. DA-CW09-71-C-0003.
—Foundation Co. of Canada Ltd., Ingram Contractors, Inc., and Atlantic Tug and Equipment Co., (joint venture), Harvey, La. $1,647,000. Removal of sunken vessels and other obstructions to navigation in the New Orleans harbor. Army Engineer District, New Orleans, La. DA-CW 29-71-C-0005.
10—Mosser Construction Inc., Fremont, Ohio. $6,605,415. Construction of flood protection system along the Sandusky River near Fremont, Ohio. Army Engineer District, Buffalo, N.Y. DA-CW49-71-C-0008.
—Westinghouse Electric Corp., Birmingham, Ala. $1,146,335. 32 unit substations for Safeguard electrical systems. Chicago, Ill., Pittsburgh and Sharon, Pa., and South Boston, Va. Army Engineer District, Huntsville, Ala. DA-CA87-71-C-0002.
—Devault Contracting Co., Inc., Kimberton, Pa. $1,041,500. Construction of approximately one mile of levee, with miscellaneous concrete structures. Nichols, N.Y. Army Engineer District, Baltimore, Md. DA-CW31-71-C-0007.
13—Bell Helicopter Co., Amarillo AFB, Tex. $3,885,973. Repair of 91 UH-1 series crash damaged aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-D-0056.
15—W.D. Jeffrey Construction Co., Fort Smith, Ark. $1,095,210. Construction of bank stabilization revetments and dikes along the Arkansas River, Faulkner, Perry and Pulaski Counties. Army Engineer District, Little Rock, Ark. DA-CW03-71-C-0003.
16—The Safeguard System Command, Huntsville, Ala., issued the following contract modifications:
Global Associates, Oakland, Calif. $1,-858,363. Logistic support at Kwajalein Missile Range, Marshall Islands. DA-HC60-70-C-001.
IBM Corp., Gaithersburg, Md. $1,274,-249. Preliminary ballistic missile defense software development for data processing system. DA-HC60-70-C-0052.
—Hensel-Phelps Construction Co., Burlingame, Calif. $4,075,000. Construction of the Grandad Creek bridge. Dworshak dam

and reservoir, Clearwater County, Idaho. Army Engineer District, Walla Walla, Wash. DA-CW68-71-C-0017.

—Novo Corp., Berkely, Calif. $3,039,741. Container stuffing services for the Oakland Army Base, Calif. Directorate of Procurement, Western Area, Military Traffic Management and Terminal Service, Oakland, Calif. DA-HC23-71-D-0001.

—Martin-Zachery Constructors, Honolulu, Hawaii. $1,487,083 (contract modification). Construction of additional cinesextant facilities, Kwajalein Atoll, Marshall Islands. Army Engineer District, Honolulu, Hawaii. DA-94612-ENG-00411.

17—A.D. Roe Co., Inc., Louisville, Ky. $1,363,670. Construction of access facilities, including interpretive center, comfort stations, overlooks, and water and sewage plants, Green River Reservoir, Taylor and Adir Counties, Ky. Army Engineer District, Louisville, Ky. DA-CW27-71-C-0007.

—J. P. Cullen and Son Corp., Janesville, Wis. $1,193,508. Relocation of roads, railroads, utility lines, site grading and drainage in preparation for acid plant construction, Army Ammunition Plant, Joliet, Ill. Army Engineer District, Chicago, Ill. DA-CA23-71-C-0002.

21—B.G. Danis Co., Dayton, Ohio. $2,328,878. Construction of a two-story building for a computer science center, Wright-Patterson AFB, Ohio. Army Engineer District, Louisville, Ky. DA-CA27-71-C-0003.

23—Litton Systems, Inc., Van Nuys, Calif. $6,428,000. Development, manufacture and test of Air Defense Guided Missile System prototypes, AN/TSQ-73. Salt Lake City, Utah, and Van Nuys. Army Missile Command, Huntsville, Ala. DA-AH01-71-C-0012.

—The Army Aviation Systems Command, St. Louis, Mo., issued the following contracts for maintenance support, modifications, maintenance and repair of crash-damaged aircraft in the Republic of Vietnam:

Dynalectron Corp., Fort Worth, Tex. $8,029,657. DA-23-204-AMC-04022(T).

Lear Siegler, Inc., Oklahoma City, Okla. $7,434,147. DA-23-204-AMC-04023.

Lockheed Aircraft Corp., Midwest City, Okla. $8,225,765. DA-23-204-AMC-04024.

24—Raytheon Co., Andover, Mass. $1,099,987 (contract modification). Engineering services for the Hawk missile. Bedford and Andover, Mass., and White Sands Missile Range, N.M. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0195.

—Sunrise Construction, Inc., Las Vegas, Nev. $1,306,000. Construction of a squadron operations facility, Nellis AFB, Nev. Army Engineer District, Los Angeles, Calif. DA-CA09-71-C-0006.

—Associated Contracting and Building Co., Lorraine, Ohio. $2,466,000. Construction of a reinforced concrete pumping station (three pumps and intake structures), Central and Southern Florida Flood Control Project, Glades County, Fla. Army Engineer District, Jacksonville, Fla. DA-CW17-71-C-0015.

27—Human Resources Research Organization, Alexandria, Va. $1,500,000. (contract modification). Continuation of research and scientific studies in support of the Human Resources Research Program. Army Research Office, Alexandria, Va. DA-HC19-70-C-0012.

—H.B. Zachry Co., San Antonio, Tex. $2,071,189. Construction of flood control channel improvements and flood walls along approximately 2.1 miles of the San Antonio River, Bexar County, Tex. Army Engineer District, Fort Worth, Tex. DA-CW63-71-C-0004.

—Johnson-Green Co., Ann Arbor, Mich. $14,721,441. Construction of a 10,200 foot dam, 420 foot spillway and 120 foot concrete deck bridge, Alum Creek Reservoir Project, Delaware County, Ohio. Army Engineer District, Huntington, W. Va. DA-CW69-71-C-0014.

28—M.F. Goerdt Construction Co., and J.F. Brennan Co., Inc. (joint venture), Dubuque, Iowa. $2,495,113. Construction of approximately 4 miles of new levee and flood wall, Dubuque. Army Engineer District, Rock Island, Ill. DA-CW25-71-C-0007.

29—Varo., Inc., Garland, Tex. $2,706,003. Image intensifier assemblies, 25mm. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-C-0012.

—Penner Construction Co., Denver, Colo. $1,114,200. Construction of an armament and electronics building, arming and disarming pad, automotive maintenance shop, ground support equipment shop and storm drainage system, and widening of taxiway, Buckley Air National Guard Base, Aurora, Colo. Army Engineer District, Omaha, Neb. DA-CA45-71-C-0011.

—Pace Corp., Memphis, Tenn. $2,488,000 (contract modification). M127A1 parachute signals. DA-AA21-70-C-0381. $1,549,680 (contract modification). M159 White Star Cluster signals. DA-AA21-70-C-0382. Memphis and Camden, Ark. Picatinny Arsenal, Dover, N.J.

—Raytheon Corp., Bedford, Mass. $8,690,639 (contract modification). Engineering development and definitization portion of the augmented advanced development of the SAM-D missile system. Bedford and Orlando, Fla. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1955.

—Kisko Co., Inc., St. Louis, Mo. $1,509,136 (contract modification). Metal parts for 105mm cartridge cases. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0083.

—The Army Engineer Division, Huntsville, Ala., issued the following contracts:

Ralph M. Parsons Co., Los Angeles, Calif. $1,103,006 (contract modification). Preparation of standard design and site adaptation of the design for the Missile Site Radar site, Grand Forks, N.D., and checking shop drawings. DA-CA87-68-C-0001.

ITE Imperial Corp., Philadelphia, Pa. $1,244,428. Switchgear reactors and resistors for Safeguard site electrical systems. Philadelphia and Chalfonte, Pa. DA-CA87-71-C-0009.

—Western Electric Co., New York, N.Y. $3,975,956 (contract modification). 369,610 integrated circuit packages. Motorola, Inc., Phoenix, Ariz., WE Co., New York, N.Y., and Texas Instruments, Inc., Dallas, Tex. $7,852,370 (contract modification). Phase I of the Safeguard Ballistic Missile Defense System (Aug. 1, through Sept. 30, 1970). Martin Marietta Corp., Orlando, Fla., Raytheon Co., Bedford, Mass., WE Co., Greensboro, N.C.; GE Co., Syracuse, N.Y.; and other subcontractors. Safeguard Systems Command, Huntsville, Ala. DA-HC60-68-C-0017.

30—Chandler-Evans, West Hardford, Conn. $1,092,000. Overhaul of fuel controls on 400 UH-1 engines. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-D-0088.

31—Western Electric Co., New York, N.Y. $75,000,000. Continued research and development of the Safeguard Ballistic Missile System. New York, N.Y., and Burlington, N.C.; Martin Marietta Corp., Orlando, Fla.; Raytheon Co., Bedford, Mass.; McDonnell-Douglas, Santa Monica, Calif.; IBM Corp., Morris Plains, N.J.; GE Co., Syracuse, N.Y.; General Research Corp., Santa Barbara, Calif.; and other subcontractors. DA-HC60-71-C-0005. $3,195,900. FY 1971 research, development, test and evaluation training effort in the areas of training aids, engineering, task and skill analysis for the Safeguard Ballistic Missile System. WE Co., New York; Raytheon Co., Bedford, Mass.; GE Co., Syracuse, N.Y., and Huntsville, Ala.; Systems Development Corp., Santa Monica, Calif.; and other subcontractors. DA-HC60-69-C-0010. Safeguard System Command, Huntsville, Ala.

—Bell Helicopter Co., Fort Worth, Tex. $35,845,413. OH-58A helicopters and related data. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-C-1699.

—Great Lakes Dredge and Dock Co., Baltimore, Md. $3,839,680. Dredging two anchorages in the Hampton Roads Project, Va. Army Engineer District, Norfolk, Va. DA-CW65-71-C-0002.

—Electro Space Corp., Westbury, N.Y. $8,014,454. AN/PRC-77 radio sets and RT-841/PRC-77 receiver transmitters. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0034.

—Ford Motor Co., Dearborn, Mich. $2,020,510. Engineering support services for the M151, M718 and M825 vehicle series. Army Tank Automotive Command, Warren, Mich. DA-AE07-71-C-0009.

—Engineered Devices, Inc., Agawam, Mass. $1,778,400 (contract modification). 156 Model 30C fire trucks. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-70-C-7988.

—Olin Corp., East Alton, Ill. $2,113,398 (contract modification). 81mm illuminating projectiles, M301A3. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0168.

DEPARTMENT OF THE NAVY

1—Hughes Aircraft Co., Culver City, Calif. $24,403,000 (contract modification). Incremental funding for AN/AWG-9 airborne missile control systems. Canoga Park, Culver City, Los Angeles and El Segundo, Calif., and Tucson, Ariz. Naval Air Systems Command, Washington, D.C. N00019-70-C-0207.

6—Submarine Signal Div., Raytheon Co., Portsmouth, R.I. $1,347,653. Refurbishment of AN/BQS-13 detecting-ranging sonar. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1403.

—Westinghouse Electric Corp., Washington, D.C. $1,863,770. Poseidon gas generators. Sunnyvale, Calif. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-0200.

—Massachusetts Institute of Technology, Cambridge, Mass. $2,550,000. Research and development for computer systems. Office of Naval Research, Washington, D.C.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Garret Corp., Phoenix, Ariz. $2,500,000. Services and materials to conduct a product support program for T-76 engines. N00019-70-C-0362.

Kollsman Instrument Corp., Elmhurst, N.Y. $4,071,890. AAU-21/A altimeter encoders and associated equipment. Elmhurst and Syosset, N.Y. N00019-70-C-0574.

Texas Instruments, Inc., Dallas, Tex. $2,276,656. Guidance sections for Shrike missiles. N00019-70-C-0606.

Honeywell, Inc., Minneapolis, Minn. $1,040,000. AN/APN-171(V) altimeter sets. N00019-70-C-0517.

Canadian Commercial Corp., Ottawa, Canada. $2,808,368. Engineering services for T400-CP-400 engines. Longueuil, Canada. N00019-70-C-0403.

—Whittaker Power Systems Corp., Primos, Pa. $1,199,342. 1,149 P.U. 656/M.A.C. generating systems, ancillary equipment and supporting data for MRC-83 and MRC-87 radio equipment. Hq., Marine Corps, Washington, D.C. M00027-70-C-0165.

7—The Naval Air Systems Command, Washington, D.C., awarded the following contracts:

Ryan Aeronautical Co., San Diego, Calif. $8,980,000 (contract modification). BQM-34E aerial target systems. N00019-69-C-0698.

McDonnell Douglas Corp., Long Beach, Calif. $59,604,992. TA-4J aircraft. Palmdale, Calif. N00019-70-C-0236.

Raytheon Co., Lexington, Mass. $10,709,787 (contract modification). Sparrow missile guidance and control units. Lowell, Andover, Waltham and Bedford, Mass., Bristol, Tenn., and Oxnard, Calif. N00019-69-C-0358.

McDonnell Douglas Corp., St. Louis, Mo. $35,905,984. F-4E aircraft. N00019-70-C-0559. $27,243,004. F-4J aircraft. N00019-70-C-0090. $121,598,473. RF-4E aircraft. N00019-70-C-0536. $3,081,000 (contract modification). Long lead time items for F-4E and RF-4C aircraft. N00019-69-C-0521.

8—Martin-Marietta Corp., Middle River, Md. $1,129,000. Component parts for the ZAP

weapon system. Naval Ordnance Laboratory, Silver Spring, Md. N60921-70-C-0088.

9—Westinghouse Electric Corp., Baltimore, Md. $1,572,000. Design, development, test and evaluation of proposed modification to the Mk 48-0 torpedo and Mk 27-0 target. Lansdowne, Md. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1216.

—Fine and Salzberg, Inc., Norfolk, Va. $2,377,683. Construction of a correction center, Naval Station, Norfolk, Va. Commander, Atlantic Div., Naval Facilities Engineering Command, Norfolk, Va. N62470-69-C-0857.

—Vitro Laboratories, Silver Spring, Md. $10,316,000. Engineering services for system integration, testing and logistics for the Poseidon fleet ballistic missile program. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-C-0006.

—General Electric Co., Schenectady, N.Y. $47,374,000. Design and furnishing of nuclear propulsion components. Naval Ship Systems Command, Washington, D.C. N00024-69-C-5154.

—The Naval Aviation Supply Office, Philadelphia, Pa., issued the following contracts:

Sikorsky Aircraft Div., United Aircraft Corp., Stratford, Conn. $2,200,013. Dynamic drive components for CH-53A/D aircraft. N000383-69-A-3900-1668.

Airesearch Manufacturing Co., Torrance, Calif. $1,670,000. Central air data computers for modification of F-4B aircraft. N00383-69-A-3901-0122.

10—Lockheed Aircraft Corp., Burbank, Calif. $30,000,000. (contract modification). Incremental funding for the S-3A weapon system. N00019-69-C-0385. $3,200,000. RP-3D aircraft. N00019-70-C-0158. Naval Air Systems Command, Washington, D.C.

—The Naval Strategic Systems Project Office, Washington, D.C., issued the following contracts:

Lockheed Missile and Space Co., Sunnyvale, Calif. $34,277,882. Tactical engineering services in support of the fleet ballistic missile weapon system. N00030-71-C-0014. $3,259,500 (contract modification). Operational systems development program for the Poseidon missile. N00030-66-C-0186. $10,703,200. Fleet ballistic missile technical engineering support services. N00030-71-C-0011.

Lockheed Aircraft Corp., Sunnyvale, Calif. $120,000,000. Poseidon missile production. Sunnyvale and Magna, Utah. N00030-71-C-0069.

13—General Atronics Corp., Philadelphia, Pa. $1,940,827. 470 AN/SRN-12 receivers, engineering services, repair parts and data. Naval Electronics Command, Washington, D.C. N00039-70-C-0558.

—Motorola, Inc., Scottsdale, Ariz. $3,534,000. Short/long range integrated control system. Naval Air Systems Command, Washington, D.C. N00019-70-C-0560.

14—McDonnell Douglas Corp., Long Beach, Calif. $3,601,000 (contract modification). Long lead time items in support of FY 1971 procurement of TA-4J and A-4M aircraft, and supplemental support of FY 1970 A-4M procurement. Naval Air Systems Command, Washington, D.C. N00019-69-C-0390.

—Intercontinental Manufacturing Co., Garland, Tex., $1,480,768. Mk 82 Mod 2 bomb bodies. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-70-C-A167.

15—The Naval Ship Systems Command, Washington, D.C., issued the following contracts:

Sperry Rand Corp., Syosset, N.Y. $2,340,000. 14,500 mandays of technical assistance for the overhaul of Benjamin Franklin (SSBN 640) class nuclear-powered fleet ballistic missile submarines. N00024-71-C-5031.

General Dynamics Corp., $60,500,000 (contract modification). Preparation, and overhaul, refueling and C-3 Poseidon conversion of USS Casimir Pulaski (SSBN 633) and USS Stonewall Jackson (SSBN 634). Groton, Conn. N00024-69-C-0214 PZ09.

Bath Iron Works Corp., Bath, Maine. $19,293,876. Modernization and repair of the USS Dale (DLG 19), USS Richmond K. Turner (DLG 20) and USS Halsey (DLG 23). N00024-68-C-0226 PO17.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Hughes Aircraft Co., Culver City, Calif. $7,576,645 (contract modification). Long lead time items for AN/AWG-9 airborne missile control systems. N00019-70-C-0207.

Kaman Aerospace Corp., Bloomfield, Conn. $2,547,611 (contract modification). Long lead time items for conversion of UH-2A/B helicopters to HH-2D configuration. N00019-70-C-0051.

—National Steel and Shipbuilding Co., San Diego, Calif. $1,757,930. Regular overhaul of the USS Thomaston (LSD 28). Supervisor of Shipbuilding, Conversion and Repair, Eleventh Naval District, San Diego, Calif. N62791-70-B-0506.

—Texas Instruments, Inc., Dallas, Tex. $1,264,941. Manufacture and test of guidance sections for Shrike guided missile, AGM-45-7. Naval Purchasing Office, Los Angeles, Calif. N00123-71-C-0201.

16—Grumman Aerospace Corp., Bethpage, N.Y. $6,600,000 (contract modification). Modification of A-6A aircraft to KA-6D configuration. Bethpage and Stuart, Fla. N00019-70-C-0458. $12,300,000 (contract modification). Long lead time items in support of FY 1971 F-14A aircraft procurement. N00019-69-C-0422.

17—James E. Roberts Co., Oakland, Calif. $1,269,000. Construction of temporary lodging facilities, Naval Air Stations, Alameda and Lemoore, Calif. Naval Facilities Engineering Command, Washington, D.C. N62474-70-C-0730.

20—Bendix Corp., Baltimore, Md. $10,304,116. 3 year contract for WRC-1 communications equipment, parts, services and data. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-0059.

21—United Aircraft Corp., East Harford, Conn. $4,292,706 (contract modification). TF-30-P-412 aircraft engines. Naval Air Systems Command, Washington, D.C. N00019-70-C-0208.

—Gall and Landau Construction Co. and Braund, Inc., and SS Contractors, Inc., (joint venture), Seattle, Wash. $3,444,500. Construction of 200 family housing units, Naval Shipyard, Bremerton, Wash. Naval Facilities Engineering Command, Washington, D.C. N62476-70-C-0052.

22—Grumman Aerospace Corp., Bethpage, N.Y. $6,700,000 (contract modification). Long lead time items for the A-6A aircraft program. Naval Air Systems Command, Washington, D.C. N00019-69-C-0075.

—Aero Corp., Lake City, Fla. $1,507,204 (contract modification). Progressive rework on P-2 series aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0136.

—IBM Corp., Gaithersburg, Md. $1,252,104. Furnishing of mass storage media units for computer systems. Naval Ship Systems Command, Washington, D.C. N00024-71-C-1007.

23—Hyundai America Corp., Agana, Guam. $6,660,800. Construction of 271 family housing units, Naval Complex, Guam. Naval Facilities Engineering Command, Washington, D.C. N62766-70-C-0056.

—Radiation, Inc., Melbourne, Fla. $1,685,563. Design, fabrication and installation of C-band sensitivity improvement antennae modification for the USNS Arnold and USNS Vandenberg. Naval Regional Procurement Office, Los Angeles, Calif. N00123-71-C-0054.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Lockheed Aircraft Corp., Burbank, Calif. $4,379,869. Technical management of computer software equipment, implementation of revisions and improvements and maintenance of the overall P-3C aircraft computer program. N00019-70-C-0493. $3,700,000 (contract modification). Long lead time items for FY 1971 P-3C aircraft procurement. N00019-70-C-0158. $1,763,871. Conversion of P-3A aircraft to EP-3E configuration. N00019-70-C-0631.

RCA, Camden, N.J. $1,123,333. Operation and maintenance of the Atlantic Fleet Range Facility, Roosevelt Roads, P.R. N00019-71-C-0048.

24—The Naval Ship Systems Command, Washington, D.C., issued the following contracts:

Westinghouse Electric Corp., Pittsburgh, Pa. $11,542,083 (contract modification). Design and furnishing of nuclear propulsion components. N00024-69-C-5101 P014.

North American Rockwell Corp., Anaheim, Calif. $1,349,000. FY 1971 operation and engineering support of the Mk 2 Ships Inertial Navigation System (SINS). N00024-71-C-5017.

—Grumman Aerospace Corp., Bethpage, N.Y. $9,000,000 (contract modification). Modification of E-2A aircraft to the E-2A/APS-111 configuration. Naval Air Systems Command, Washington, D.C. N00019-68-C-0542.

—Hughes Aircraft Co., Culver City, Calif. $9,000,000. Mk 3 guidance system electronic assemblies and associated components for the Poseidon weapon system. El Segundo, Calif. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-C-0047.

—The Naval Facilities Engineering Command, Washington, D.C., awarded the following contracts:

Everett S.M. Brunzell Corp., Reno, Nev. $3,570,000. 190 family housing units, Naval Air Station, Lemoore, Calif. N62474-70-C-0635.

Leadership Housing System, Inc., Newport Beach, Calif. $2,141,762. 102 family housing units, Camp Pendelton Marine Corps Base, Calif. N62473-70-C-0029.

27—Control Data Corp., Bethesda, Md. $3,621,000. Engineering services to support equipment for fleet ballistic missile system training. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-C-0002.

—The Naval Ship Systems Command, Washington, D.C., awarded the following contracts:

Computer Sciences Corp., Falls Church, Va. $1,145,000. Data processing and analysis related to fleet maintenance support, overhaul and readiness for the maintenance and material management system. N00024-69-C-5220.

General Dynamics Corp., Groton, Conn. $29,838,750. Preparation for and accomplishment of the overhaul, refueling and Poseidon C-3 missile conversion of the USS Von Steuben (SSBN 632). N00024-68-C-0320. $2,092,869. Preparation for the overhaul of the USS Pargo (SSN 650). N00024-71-C-0203.

Sperry Rand Corp., Syosset, N.Y. $1,387,756. Program of shipyard technical services related to the second overhaul of the navigation subsystem aboard the USS George Washington (SSBN 598), USS Patrick Henry (SSBN 599) and USS Robert E. Lee (SSBN 601). Charleston Naval Shipyard, S.C., and Puget Sound Naval Shipyard, Bremerton, Wash. N00024-71-C-5001.

North American Rockwell Corp., Anaheim, Calif. $4,284,608. Testing, repair and modification of 931 Mk 2 Ships Inertial Navigation System (SINS) instruments. N00024-71-C-5013.

28—J.W. Bateson Co., Arlington, Va. $8,923,000. Construction of a library and education center, Naval Academy, Annapolis, Md. Naval Facilities Engineering Command, Washington, D.C. N62477-68-C-0083.

—Conceen Construction Corp., El Cajon, Calif. $2,395,000. Construction of temporary lodging facilities, Naval Air Stations, Miramar and North Island, and Naval Station, San Diego, Calif. Naval Facilities Engineering Command, Washington, D.C. N62473-70-C-0104.

—North American Rockwell Corp., Anaheim, Calif. $3,400,000. Inspection, repair, modification and testing of 1,850 Mk 2 Ships Inertial Navigation System (SINS) instruments and training equipment with associated components. Naval Ship Systems Command, Washington, D.C. N00024-71-C-5012.

29—Litton Systems., Inc., Van Nuys, Calif. $7,205,000. Direct air support central system, including digital data, communications and display equipment. Naval Electronic Systems Command, Washington, D.C. N00039-70-C-3548.

—Singer-General Precision, Inc., Glendale, Calif. $5,345,000. Mk 113 Mod 8 fire control systems. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1214.

—Collins Radio Co., Newport Beach, Calif. $1,729,056. KG-40 key generators. Naval Electronic Systems Command, Washington, D.C. N00039-71-C-0206.

—General Electric Co., Cincinnati, Ohio. $1,245,108. Retrofit kits for conversion of T-58-GE-8B engines (H-46, H-3 and H-2 helicopters) to -8F configuration. F34601-70-A-0962-GB40. $2,205,667. Retrofit kits for J-79-GE-10 engines for F-4 series aircraft. F34601-70-A-1018-GB40. Naval Aviation Supply Office, Philadelphia, Pa.

30—The Naval Ship Systems Command, Washington, D.C., issued the following contracts:

Sperry Rand Corp., Charlottesville, Va. $1,262,194. 10 periscopes, adapters, engineering services, associated technical data and onboard repair parts. N00024-71-C-5053.

Sperry Rand Corp., Syosset, N.Y. $2,214,190. Inspection, repair and modification of 1,690 Mk 3 navigation subsystem components, related data and reports. N00024-71-C-5004.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Grumman Aerospace Corp., Bethpage, N.Y. $8,000,000 (contract modification). Long lead time items to support FY 1971 EA-6B aircraft procurement. N00019-70-C-0458.

General Electric Co., Utica, N.Y. $2,087,695 (contract modification). AN/AYA-8 data processing systems for P-3C aircraft. N00019-70-C-0124.

31—The Naval Facilities Engineering Command, Washington, D.C., awarded the following contracts:

Ivey's Plumbing and Electrical Co., Inc., Kosciusko, Miss. $1,093,823. Installation of air conditioning for the airmen's dormitories, Keesler AFB, Miss. N62467-70-C-0498.

Fox-Sadler Co., Inc., Virginia Beach, Va. $1,018,212. Construction of Bachelor Officer's Quarters, Fleet Anti-Air Warfare Training Center, Dam Neck, Va. N62470-70-C-1162.

DEPARTMENT OF THE AIR FORCE

1—The Military Airlift Command, Scott AFB, Ill., issued the following contracts for domestic cargo air transportation services in support of the AFLC LOGAIR system:

Saturn Airways, Inc., Oakland, Calif. $6,185,265. F11626-70-C-0043.

Airlift International, Inc., Miami, Fla. $4,590,669. F11626-70-C-0042.

Universal Airlines, Inc., Ypsilanti, Mich. $12,389,675. F11626-70-C-0044.

Overseas National Airways, Inc., Jamaica, N.Y. $10,875,907. F11626-70-C-0045.

—Pan American World Airways, Inc., New York, N.Y. $86,158,700. Services for the operation and maintenance of the test facilities of the Eastern Test Range, Patrick AFB, Fla. Air Force Eastern Test Range, Patrick AFB, Fla. F08606-68-C-0040.

—Emerald Maintenance, Inc., Sandpoint, Idaho. $1,060,000. Maintenance and operation of the Kodiak tracking station, Alaska. Alaskan Air Command. F65517-69-C-0005.

—The Aerospace Defense Command, Ent AFB, Colo., issued the following contracts:

Systems Development Corp., Santa Monica, Calif. $4,800,000. Computer program updating and development of a system training program. F05604-70-C-0008. $2,128,565. Computer program updating and development of system training programs for major air commands and foreign countries. Santa Monica, Offutt AFB, Neb., Hickam AFB, Hawaii, Langley AFB, Va., Elmendorf AFB, Alaska, National Guard Bureau, Washington, D.C., and foreign countries. F05604-70-C-0009.

General Electric Co., Syracuse, N.Y. $9,975,690. Operation, maintenance and logistics support of spacetract sensor sites. Syracuse, Shemya AFS, Alaska, and Diyarbakir, Turkey. F05604-70-C-0012.

ITT Arctic Services, Inc., Paramus, N.J. $36,092,377. Services and material for the operation, maintenance and logistic suport of BMEWS, operation and maintenance of the microwave communications facility at "J" site, and logistic supply support for Thule AB, Greenland. F04606-69-C-0555. $24,900,042. Operation, maintenance and logistic support of DEW line, North Atlantic radio system, and BMEWS north submarine cable terminal. Alaska, Canada, Greenland, Iceland, Great Britain and New Jersey. F04606-69-C-1108.

—The Armament Development and Test Center, Eglin AFB, Fla., issued the following contracts:

Vitro Corp. of America, Valparaiso, Fla. $11,290,508. Maintenance and operation of the Armament Development and Test Center range facilities. F08635-71-C-0071.

Martin Marietta Corp., Orlando, Fla. $1,246,943. Air munitions components. F08635-70-C-0221.

—Automatic Sprinkler Corp. of America, Carrollton, Tex. $1,461,895. 750-pound bomb fin assemblies. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-70-C-0208.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

Lockheed Aircraft Corp., Sunnyvale, Calif. $5,553,202. An advanced data system for a satellite control facility. F04695-67-C-0176.

The Boeing Co., Seattle, Wash. $6,543,776. Design, development, integrated test operations and evaluations for Minuteman missiles. F04701-70-C-0137.

—Curtis-Wright Corp., East Paterson, N.J. $3,430,840. Helicopter flight simulators. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-1097.

—Overseas National Airways, Inc., Jamaica, N.Y. $7,841,580. Domestic cargo air transportation services in support of the Navy's QuickTrans system. Military Airlift Command, Scott AFB, Ill. F11626-70-C-0046.

2—Fairchild-Hiller Corp., St. Augustine, Fla. $2,072,725. Inspection and repair as necessary, and modification of C-130 Hercules aircraft. St. Petersburg-Clearwater International Airport, Fla. Warner-Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-70-C-1542.

—General Dynamics Corp., Fort Worth, Tex. $35,000,000. Long lead time effort to implement the F-111F program. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-1130.

—The Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla., issued the following contracts:

Lear Siegler, Inc., Oklahoma City, Okla. $1,890,340. Contractor field teams to perform corrosion control and modification on C-141 aircraft. F34601-70-D-3564.

Dynalectron Corp., Fort Worth, Tex. $2,445,000. Contractor field teams to perform corrosion control on B-52, KC-135 and other aircraft. Anderson AB, Guam, and Kadena AB, Okinawa. F34601-70-D-3563.

6—Lockheed Aircraft Corp., Marietta, Ga. $24,340,385. Wing modification of C-130 Hercules aircraft. Warner-Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-68-C-2530.

—Koppers Co., Inc., Baltimore, Md. $1,387,208. Noise suppressor system for F-4 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1195.

—Thiokol Chemical Corp., Brigham City, Utah. $12,866,393. Minuteman III stage III motors. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0182.

—ARO, Inc., Arnold AFS, Tenn. $45,100,000. Management, operation and maintenance of the Arnold Engineering Development Center, and research, development, test and evaluation programs. Arnold Engineering Development Center, Arnold AFS, Tenn. F40600-71-C-0002.

7—General Dynamics Corp., Fort Worth, Tex. $1,098,000. Operation, maintenance and improvement of the radar target scatter facility in obtaining characteristic radar data of signal return from various aerospace vehicles. White Sands Missile Range and Holloman AFB, N.M. Missile Development Center, AFSC, Holloman AFB, N.M. F33657-69-C-1028.

8—Lockheed Georgia Co., Marietta, Ga. $2,706,724. Development, activation and operation of a ground data processing system to process maintenance and logistics data recorded on-board aircraft. Procurement Division, Wright-Patterson AFB, Ohio. F33600-70-C-0262.

9—General Motors Corp., Indianapolis, Ind. $18,150,825. T-56-A-14 turboprop engines, support equipment and data. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0222.

10—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

The Boeing Co., Seattle, Wash. $7,500,000. Research and development of a short range attack missile (SRAM). AF33(657)-16548.

United Aircraft Corp., East Hartford, Conn. $3,098,720. Fabrication and testing of borsic/aluminum composite turbofan blades for TF-30 series engines. F33657-70-C-0624.

—McDonnell-Douglas Corp., Tulsa, Okla. $2,335,860. Modification, and inspection and repair as necessary of B-52 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-C-4368.

—Sylvania Electric Products Inc., Waltham, Mass. $2,217,076. Supplies and services in support of the Minuteman ground electronics system. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0187.

13—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

General Electric Co., Philadelphia, Pa. $1,260,000. Research and development of the Mk 12 reentry vehicle. AF 04-694-975.

Lockheed Aircraft Corp., Sunnyvale, Calif. $3,245,207. Research and development of the Air Force Satellite Control Facility. F04701-70-C-0068.

—General Dynamics Corp., Fort Worth, Tex. $1,260,000. Spare parts for the F-111 aircraft. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. AF33(657)-13403.

14—Teledyne CAE, Toledo, Ohio. $1,500,000. Component improvement program for the J-69-T-25/29/41A series aircraft engines. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0757.

15—RCA, Moorestown, N.J. $1,531,600. Depot level maintenance and supply support for radar equipment at various installations. Eastern Test Range, AFSC, Patrick AFB, Fla. F08606-70-C-0048.

—Philco-Ford Corp., Palo Alto, Calif. $9,490,272. Engineering support for the Satellite Control Facility. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0029.

16—Lockheed Aircraft Corp., Marietta, Ga. $7,401,570. Spare parts for C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657)-15053.

17—Itek Corp., Inc., Sunnyvale, Calif. $4,792,381. Airborne radar receivers and related test equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0383.

20—Lockheed Aircraft Corp., Marietta, Ga. $50,000,000. C-5A aircraft. Aeronautical Systems Division, AFSC, Wright-Patter-

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son AFB, Ohio. AF33(657)-15053.

21—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, awarded the following contracts:
- Lockheed Aircraft Co., Sunnyvale, Calif. $5,200,000. Development of a sensor system for C-130 gunship aircraft. F33657-70-C-1200.
- Cessna Aircraft Co., Wichita, Kan. $2,830,073. Spare parts and aerospace ground equipment for A-37B aircraft. F33657-70-C-0018.

22—Collins Radio Co., Cedar Rapids, Iowa. $1,006,289. Aerospace ground equipment for integrated dual flight director/rotation go-around systems. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-69-2462.

23—Westinghouse Electric Corp., Baltimore, Md. $1,280,000. Modification kits for AN/FPS-7 radar system. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. F04606-70-C-0047.

—Sperry Rand Corp., St. Paul, Minn. $8,760,000 (contract modification). Design and development of a Minuteman weapon system computer. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0111.

24—North American Rockwell Corp., Anaheim, Calif. $65,689,000. FY 1971 production of guidance and control systems for the Minuteman III weapon system. Space and Missile Systems Organization, Los Angeles, Calif. F04701-69-C-0104.

—McDonnell Douglas Corp., Long Beach, Calif. $8,500,076. Logistic support for the C-9A aircraft. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-68-C-0001.

27—AVCO Corp., Greenwich, Conn. $2,080,-
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AN/APX-83(V) airborne radar systems. F33657-70-C-1004.

28—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:
- Texas Instruments, Inc., Dallas, Tex. $6,360,000. Guidance kits for air munitions. F33657-71-C-0041.
- XYZYX Information Corp., Reseda, Calif. $1,065,000. Job performance aids in English and Vietnamese applicable to C-123K and CH-47A aircraft, training aids and materials, and services. F33657-71-C-0061.

29—RCA, Arlington, Va. $2,490,000. Rental of data processing equipment, Wright-Patterson AFB, Ohio. 2740th Air Base Wing, Wright-Patterson AFB, Ohio. F33600-71-F-0051.

30—Massachusetts Institute of Technology, Cambridge, Mass. $10,800,000. Research and development of advanced electronic systems for various DOD agencies. Lexington, Mass. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. AF19628-70-C-0230.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:
- Oshkosh Truck Corp., Oshkosh, Wis. $2,005,420. Fire fighting trucks. F33657-71-C-0047.
- The Boeing Co., Seattle, Wash. $6,750,000. Research and development of the short range attack missile (SRAM). AF33(657)-16584.

31—Federal Electric Corp., Paramus, N.J. $20,494,080. FY 1971 operation and maintenance of the Western Test Range technical facilities, Vandenberg AFB, Calif. Space and Missile Test Center, AFSC, Vandenberg AFB, Calif. F04607-67-C-0001.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:
- Aerojet-General Corp., Sacramento, Calif. $8,000,000. Fabrication and delivery of Minuteman III missile stage II motors, and associated support equipment and data. F04701-70-C-0141.
- Collins Radio Co., Dallas, Tex. $1,052,625. Communications electronics systems for the Air Force Satellite Control Facility. F04695-67-C-0137.
- Martin-Marietta Corp., Denver, Colo. $7,880,000. Design, development, fabrication and delivery of Titan IIIC boosters and associated aerospace ground equipment. F04701-70-C-0202.

"Instant Bridge" Investigated by Army

An air-inflatable bridge strong enough to support a 20-ton tank has been demonstrated for the Army.

Under a contract with the Mobility Equipment Research and Development Center, Fort Belvoir, Va., Goodyear Aerospace Corp. produced a 1/20th-scale model of the bridge. A bridge capable of spanning a 90-foot length would weigh 5,000 pounds, and fit, folded, on a 2½-ton truck.

Urethane-coated polyester fabric, constructed in two layers of integrally woven cloth, the bridge gains rigidity when inflated. Because of the low pressure—15 pounds per square inch—the bridge can maintain rigidity, even if punctured, with a portable compressor.

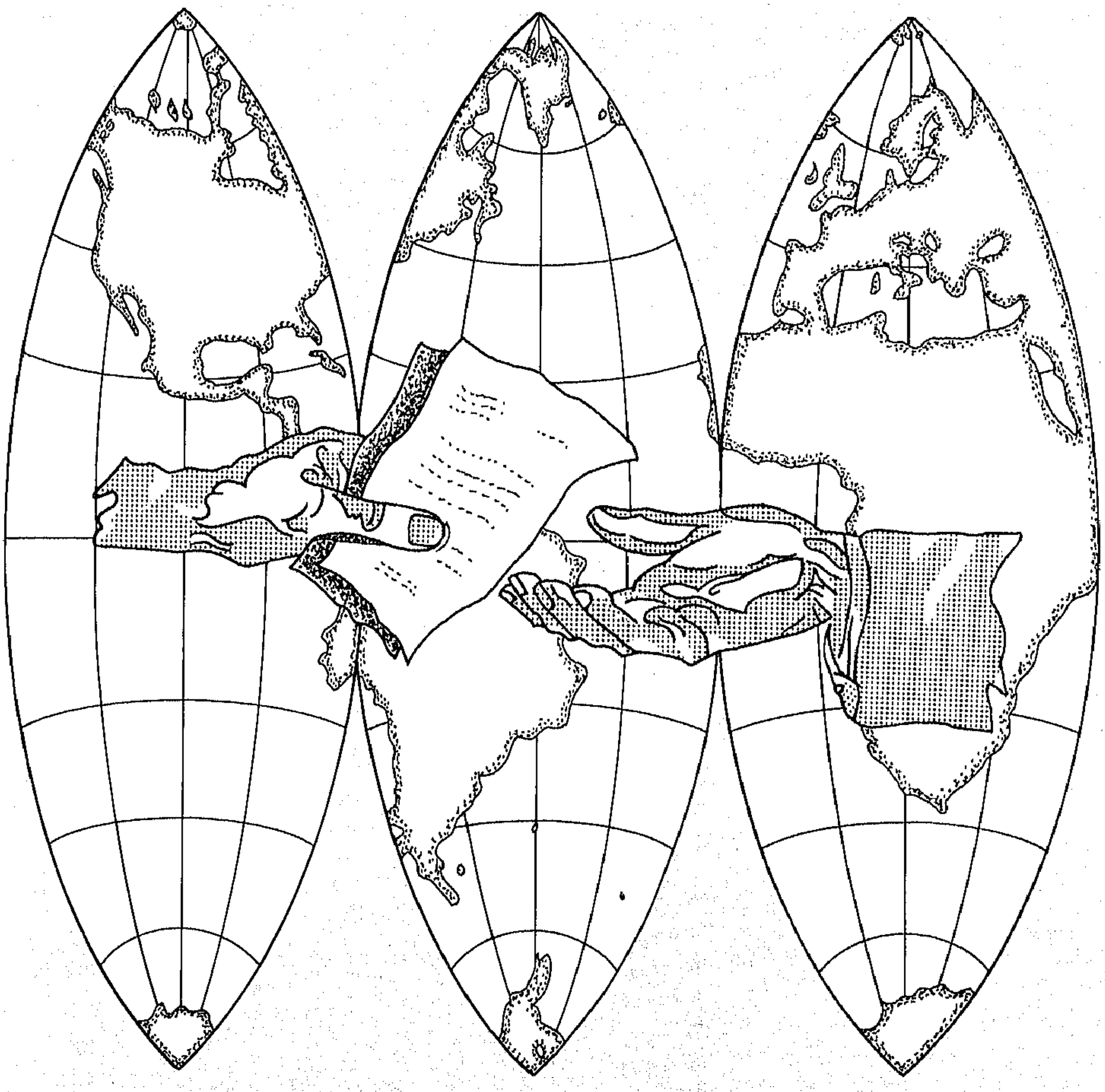
In use, the transporter truck would back to a crossing point and anchor the top pleat of the bridge. The truck would then move away, unfolding the bridge. Once the bridge is inflated, the truck would then position the structure using a boom and hook.

Engineers estimate unpacking, inflation and emplacement would take approximately 30 minutes, with the same amount of time used to deflate and repack the bridge.

☆ U.S. GOVERNMENT PRINTING OFFICE : 1970 434-569/2

DEFENSE INDUSTRY BULLETIN

OCTOBER 1970



DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 10 October 1970

Published for Department of Defense by Defense Supply Agency

The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds approved by the Director, Bureau of the Budget, Nov. 2, 1965.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

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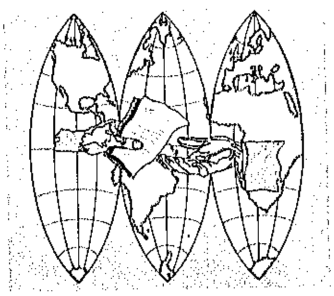
DEPARTMENTS



In the furtherance of an alliance, military information is sometimes disclosed to foreign governments or international organizations. Transfer of classified information should be regarded as prompted by expected and frequently realized mutual benefit. Articles beginning on pages 1 and 5 discuss this subject.

DOD Administration of Export Controls

Norman E. Eliasson

Who in DOD reviews your application to the Department of Commerce to export a computer?

Who gives the DOD position on whether to approve your application to the Office of Munitions Control to export a Munitions List item?

Who processes an exception to National Disclosure Policy, which is necessary before a classified brochure can be released to your potential customer, the government of X, Y or Z?

Within DOD the focal point for all of the foregoing actions is in the Office of the Assistant Secretary of Defense (International Security Affairs) [OASD(ISA)]. The particular office which handles your problem is the Stategic Trade and Disclosure Directorate, which is directly subordinate to the Principal Deputy Assistant Secretary of Defense (ISA).

The Director, Strategic Trade and Disclosure, in turn, has three small staffs. One is for Trade Control, another for Munitions Control and the third, the Foreign Disclosure Staff. The tasks performed by these three staffs are prescribed by a variety of statutes, executive orders and DOD directives, and can best be understood if the three functional divisions are examined individually.

Trade Control

DOD's role in U.S. and international strategic trade control derives from the Export Administration Act of 1969 and the Mutual Defense Assistance Control Act of 1951, the so-called Battle Act. Preceding the 1969 act was the Export Control Act of 1949. Both of these pieces of legislation stated that "it is the policy of the United States to use export controls to the extent necessary to exercise the necessary vigilance over exports from the standpoint of their significance to the national security of the United States." However, the 1969 act also declares U.S. policy to be "to encourage trade with all countries with which we have diplomatic or trading relations."

Meanwhile, one purpose of the Battle Act is "to provide for the control by the United States and cooperating foreign nations of exports to any nation or combination of nations threatening the security of the United States."

The Department of Commerce executes the Export Administration Act, while the Department of State is charged with executing the Battle Act.

It is clear that DOD, while chiefly concerned with safeguarding the national security when exercising its export control responsibilities, must do so in consonance with the national policy to encourage international trade. Further, the legislation authorizes controls over exports for three purposes—"national security," "foreign policy," and "short supply." Hence, national security controls, and short supply controls, when they are needed, must also reflect U.S. foreign policy and international responsibilities.

Commodities subject to export controls under the provisions of the Export Administration Act of 1969 are found on the Commodity Control List issued by the Department of Commerce. The purpose of the list is to keep American exporters current on what commodities require export licenses before shipment can be made abroad.

It should be noted that Canada represents somewhat of an exception. Export licenses are not required for commodities exported for internal consumption in Canada, except for commodities and technical data related to nuclear weapons, nuclear explosive devices, nuclear testing or nuclear propulsion plants, and copper scrap and alloy ingots.

The Commodity Control List shows the three major categories of country controls which are applied. Category I commodities require a validated license for export to all countries of the world (except Canada as noted before). Category II commodities require a validated license for export to

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all countries outside the Western Hemisphere but including Cuba. Category III commodities require a validated license for export only to Cuba, communist areas of Eastern Europe (except Yugoslavia) and Asia, Rhodesia, and in some instances Hong Kong, Macao, Poland, Romania and the Republic of South Africa.

Export license applications for commodities on the Commodity Control List are reviewed by the interagency Operating Committee (OC) of the Advisory Committee on Export Policy (ACEP), both chaired by the Department of Commerce. DOD is represented on the OC by members of the OASD(ISA) Trade Control staff, and on the ACEP by the Assistant Secretary of Defense (ISA). His Principal Deputy and the Director, Strategic Trade and Disclosure, are alternate members.

The transfer of Commodity Control List items to third countries by subsidiaries of U.S. firms abroad is controlled by the U.S. Treasury Department with the concurrence of other interested agencies, including DOD. Changes in the Commodity Control List itself also are subject to DOD concurrence.

The provisions of the Battle Act are carried out chiefly through the international Coordinating Committee, better known simply as COCOM. Its members are delegates from the United States and 14 allied countries (Belgium, Canada, Denmark, Federal Republic of Germany, France, Greece, Italy, Japan, Luxembourg, Norway, Portugal, The Netherlands, Turkey and the United Kingdom). COCOM has internationally agreed lists of strategic items somewhat comparable to the U.S. Commodity Control List, and member countries control the export of these items. Requests from member countries to export items on the international lists are reviewed by COCOM. U.S. review of these cases submitted to COCOM takes place within the interagency Working Group I (International Export Control System) of the Economic Defense Advisory Committee (EDAC) which operates under State Department chairmanship. Here again DOD is represented through members of the OASD(ISA) Trade Control staff.

The OASD(ISA) Trade Control staff also contributes the DOD member to U.S. teams which participate in the COCOM embargo list review and which negotiate agreements with other COCOM member countries.

The staff also represents DOD on Working Group II (Application and Enforcement) of EDAC. This group maintains the effectiveness of U.S. and COCOM embargoes through the establishment of control systems, investigative efforts, and the imposition of such penalties as can be applied in the case of violations. Working Group II also studies the problems of transit trade and enforcement involving third countries, and assembles and reviews intelligence and other relevant information on questionable East-West and other trade activities.

The foregoing OASD(ISA) Trade Control staff activities are governed by Executive Order 10945, "Administration of the Export Control Act," as amended; DOD Directive 2030.4, "DOD Support for the Strategic Trade Control Program"; and DOD Directives 2030.2, 2030.3 and 2030.5, which deal with security trade controls on foreign excess personal property and foreign nonexcess personal property sold by DOD.

Munitions Control

The Mutual Security Act of 1954, as amended, authorizes the President "to control, in furtherance of world peace and the security and foreign policy of the United States, the export and import of arms, ammunition and implements of war, including technical data relating thereto, other than by a United States Government Agency."

The President is further authorized "to designate those articles which shall be considered as arms, ammunition and implements of war, including technical data relating thereto. . . ."

Executive Order 10973 delegates to the Secretary of State all functions conferred upon the President by the Mutual Security Act. The order further decrees that in carrying out these functions the Secretary of State shall consult with appropriate agencies. However, the order specifies that "Designations, including changes in designations, by the Secretary [of State] of articles which shall be considered as arms, ammunition and implements of war, including technical data relating thereto . . . shall have the concurrence of the Secretary of Defense."

The designations in which the Secretary of Defense concurs are those appearing in the International Traffic in Arms Regulations (ITAR) which are Parts 121 through 128 of Title 22 —Foreign Relations, Code of Federal Regulations. Section 121.01 of the ITAR is the U.S. munitions list.

Proposed revisions of the ITAR may originate within DOD as well as in the Department of State. In accordance with Executive Order 10973, the OASD(ISA) Munitions Control staff coordinates the DOD position on such proposed revisions. However, the greater part of the Munitions Control staff effort is spent reviewing and recommending decisions on individual Munitions Control license request cases.

In order to expedite the review of Munitions Control cases, the Office of Munitions Control in the Department of State distributes copies of export license applications, with background data when it is required, to appropriate DOD staff elements in the Office of Defense Research and Engineering, the military departments, the Office of the Assistant Secretary of Defense (Installations and Logistics) and other organizations, such as the Joint Chiefs of Staff, if the proposed export so requires. The OASD(ISA) Munitions Control staff manages this review of munitions control cases, providing current politico-military and security guidance to the technical reviewers in the staff elements. The OASD(ISA) Munitions Control staff ultimately prepares and provides to the Office of Munitions Control the DOD-recommended decisions on the cases. These recommendations are based on security, technical and politico-military implications of each case.

Beside the foregoing activity within government channels, the Munitions Control staff maintains close and continuing contact with industry. One purpose of this contact is to save industry wasted effort in filing applications that cannot be approved. Sometimes the reasons are not readily apparent.

In the DOD review of export license applications, all cases are examined

carefully against the criteria set forth in the National Disclosure Policy (which will be discussed later) to ensure that the approval of unclassified munitions cases will not inadvertently commit the United States to future release of classified information or material. The export of unclassified information or material related to classified items requires the approval of the cognizant department or agency if release of such related classified items may later be required. The cognizant DOD component brings the situation to the attention of OASD (ISA) and either certifies that the classified item is within the limits of the National Disclosure Policy and that the eventual disclosure of classified information meets the criteria of that policy, or that the eventual disclosure will exceed the limits of that policy. In the latter instance, the cognizant component must state whether or not it is willing to sponsor a request for an exception to the National Disclosure Policy to permit the eventual disclosure.

These procedures are spelled out in DOD Directive 5030.28, "Munitions Control Procedures for U.S. Munitions List Export License Applications Referred to DOD by Department of State."

Foreign Disclosure

A familiar cautionary notice often appears in classified documents. It generally reads as follows: "This material contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, USC, Sections 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law."

For obvious reasons, such as in furtherance of an alliance, classified military information must sometimes be disclosed to foreign governments or international organizations. When this is done, it is governed by the general policy statement contained in the National Disclosure policy (NDP–1) which states: "It is the policy of the U.S. Government to treat classified military information as a national security asset which must be conserved and protected, and which may be shared with foreign entities only where there is a clearly defined advantage to the United States." Our purpose here is to explain how this is done.

In 1934 the Secretary of State suggested to the War and Navy Departments that there be consultation on the shipment of goods affecting the military security of the United States. During World War II the arrangements for the consultations became centered in the Technical Information Security Control Committee which was a subcommittee of the State, War and Navy Coordinating Committee.

It was not until 1946, however, that the President decreed there be formal arrangements for controlling the disclosure of classified military information. This action was embodied in the Presidential Directive of Feb. 27, 1946, titled, "Basic Policy Governing the Disclosure of Classified Military Information to Foreign Governments," and was reaffirmed in a second Presidential Directive on the same subject dated Sept. 23, 1958.

These Presidential Directives, together with NSC Action 2125 of Sept. 10, 1959, are the basis and forerunners of the current National Disclosure Policy (NDP–1).

The organizations which administered the policy in earlier years were the State-Defense Military Information Control Committee from 1949 to 1964 and then, until 1966, the U.S. Military Information Control Committee. Since 1966, the central authority for formulating, promulgating, administering and monitoring the National Disclosure Policy has been the National Military Information Disclosure Policy Committee (NDPC).

The current National Disclosure Policy was issued on Dec. 17, 1969, by the Secretary of Defense, with the approval of the Secretary of State and the concurrence of the Chairman of the Atomic Energy Commission and the Director of Central Intelligence. It went into effect Jan. 1, 1970. Hitherto, the chairmanship and executive direction of the NDPC had been functions of the Department of State.

With the new policy these functions were shifted to DOD. The Director, Strategic Trade and Disclosure in ISA became the Chairman, NDPC, as well as the OSD member of the committee. The Foreign Disclosure staff in OASD(ISA) serves as a secretariat for the NDPC and its director is the Executive Director of the NDPC.

The members of the NDPC are representatives of the Secretaries of State, Defense, Army, Navy and Air Force; the Joint Chiefs of Staff; the Chairman, Atomic Energy Commission; the Director of Central Intelligence; the Director of Defense Research and Engineering; the Assistant Secretary of Defense (Administration); the Assistant to the Secretary of Defense (Atomic Energy); and of the Director, Defense Intelligence Agency.

The new National Disclosure Policy has an important effect upon the exporter of classified information. While the primary purpose of the policy is to control release by the U.S. Government of U.S. classified information to foreign governments and international organizations, it also impinges upon the ability of a manufacturer to export his classified goods through export control channels, as was outlined earlier in discussing munitions control.

For purposes of definition, classified military information is information under the control or jurisdiction of the Defense Department, its departments or agencies, or of primary interest to them, which requires protection in the interests of national defense. Its classifications are Top Secret, Secret and Confidential. Classified military information may be embodied in equipment, or may be in written, oral, or other form.

Many exporters of classified military information may never have heard of NDP–1 or the NDPC, and some exporters may be unaware that approvals or denials of classified proposals have been the subject of NDPC consideration.

One may ask why no publicity is given to NDP–1 when it is, in effect, a set of national standards. These standards have not been published in the Federal Register since, primarily due to the fact that they vary by country, they are themselves classified. Accordingly, they are applied on a case-by-case basis determined by the security and foreign policy considerations inherent in each export proposal at the time of its submission.

Each proposed release of classified

military information through Munitions Control channels is examined in the light of the policy. If a manufacturer's proposal meets the criteria set forth in NDP-1, or a specific exception to it has been granted, the case is generally approved. Disapproval could mean one of three things:

• The proposed disclosure is in a prohibited area or otherwise fails to meet NDP-1 criteria.

• The request failed to meet policy standards, and no federal government agency wanted to sponsor an exception which would have allowed the release.

• The government sponsor failed to convince the members of the NDPC that an exception was in the best interests of the United States.

Underlying NDPC judgments in each case is the stated goal to strike a proper balance between the attainment of U.S. objectives on the one hand and the preservation of the security of our military secrets on the other.

A logical question is: How can an export application be prepared in such a way as to conform to a policy to which the applicant does not have access? The following suggestions may be helpful.

From the foregoing it should be clear that the U.S. Government must avoid giving a false impression of its readiness to make available classified military material, technology, or information to foreign entities. Hence, if an exporter is proposing discussions with such foreign entities of programs which might involve the eventual disclosure of classified military information, it must be explicity understood and acknowledged that no U.S. commitment to furnish such classified information or material is intended or implied. In addition, it is in the exporter's best interest to identify completely all classified components of his export proposal as early as possible, so that the required exceptions to policy or other special processing can be completed before he initiates a for-

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edge of the National Disclosure Policy is not essential for the exporter of classified items. It should suffice to know that there is a general policy which influences classified exports and provides for exceptions to that policy.

This is in essence the control activity which is commonly referred to as "Foreign Disclosure," governed by DOD Directive 5230.11, "Disclosure of Classified Military Information to Foreign Governments and International Organizations."

Mutual Understanding Needed

The most frequent complaint heard from industry concerning trade and munitions controls centers on the time that it takes to consider export applications. While DOD does not control the issuance of export licenses, the OASD(ISA) Trade Control, Munitions Control and Foreign Disclosure staffs have listened carefully to these complaints. They have sought systematically to reduce DOD processing time through organizational streamlining and the elimination of clerical delays. The Foreign Disclosure staff has developed an automated data processing system which also could be used by the Trade Control and Munitions Control staffs should the need arise. However, it is possible that we are close to an irreducible minimum in correcting staffing delays. It is axiomatic that the clear-cut case is easier to decide than the complicated one which may lack precedents or hover near the extreme limits of policy and, perhaps, contain unacceptable risks to the national security.

Working together, industry and the Government can avoid these risks to the national security, while pursuing the Export Administration Act goals "to encourage trade with all countries with which we have diplomatic or trading relations." The problems involved in achieving a proper balance between security considerations and increased international trade may not be simple, but they are far from insuperable.

Mutual understanding between industry and Government on the needs and purposes of trade controls is the ...y to achieving the maximum benefit ... nation from the exports of its ...e industry.

Improved Instrument Lights Flight Tested

An electroluminescently lighted instrument panel is being flight tested by the Air Force Systems Command's Aeronautical Systems Division. Purpose of the tests is to determine the best possible cockpit lighting for an aircraft pilot.

Basically, an electroluminescent lamp is a layer of light-emitting phosphor sandwiched between two electrodes. Proper voltage across the electrodes causes light to be emitted from the phosphor. The light remains constant from dim to bright, and color does not change as the brightness is varied.

Aircraft lighting has seldom been adequate for night missions requiring the pilot to devote attention to the night environment outside the cockpit. Pilots say that, for instance, to see their instruments they must set cockpit lights too high for night vision. Also, the regular panel lights can cause the canopy to glow, making an otherwise blacked out plane visible in a combat situation. Uneven panel lighting makes it difficult to read the instruments.

The panel being tested employs three techniques of instrument display illumination. Light-reflecting displays use electroluminescent lamps mounted on a light wedge to distribute light uniformly over the instrument surface, where it is reflected to make the instrument display visible. Light-transmitting displays use controlled light transmission through plastic panels to illuminate each legend or scale to the required amount. Finally, light-emitting displays use light as the display element and must develop the contrast that makes it visible.

With the panel, light for each instrument can be controlled individually so that the pilot has the best possible light across the instrument panel.

Project engineer for the test program is Lieutenant David Turney of the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio.

Protecting Classified Information in International Exchanges

Herbert Lewis

Classified information is by nature most intimately related to our national defense. Just as U.S. defense interests extend beyond our national boundaries, so must the use of the U.S. classified information which furthers those interests.

Those countries or treaty organizations which have a mutual defense interest with the United States are given sufficient classified information to enable them to carry out their responsibilities. This release of classified information is by no means one-sided. Other countries and treaty organizations share their classified information with the United States to further their own defense efforts. Transfer of classified information should be regarded as exchange prompted by an expected and frequently realized mutual benefit.

The classified information, both U.S. and foreign, involved in such exchanges requires appropriate protection. Since the exchanges involve defense information, the Secretary of Defense has the primary security responsibility. This function is carried out through the Assistant Secretary of Defense (Administration) and the Deputy Assistant Secretary of Defense for Security Policy. It is their responsibility to provide guidelines for protection of foreign classified information entrusted to the United States, and to provide every reasonable assurance that U.S. classified defense information entrusted to foreign countries will be properly protected.

At this point, it might be well to delineate a bit more sharply the function of the Office of the Deputy Assistant Secretary for Security Policy in the exchange program. It does not determine the nature of the classified information which is to be given or accepted. This is the function of other staff elements of DOD. But it enters into the transaction to ensure that the classified information involved receives proper protection.

As might be expected, protective measures for international exchanges are based upon various forms of international security agreements between the United States and foreign governments or international organizations. They are of two basic types of agreements—bilateral, between the United States and a particular country; and multilateral, between the United States and a group of allied countries such as the North Atlantic Treaty Organization, the South East Asia Treaty Organization, and the Central Treaty Organization.

Bilateral Agreements

Since the end of World War II, bilateral agreements have been negotiated with a number of foreign governments. These agreements vary in format and detail, depending on the nature and scope of the contemplated exchange of classified information.

The most frequently used bilateral format is called, in security parlance, a general agreement. Such agreements are negotiated between the State Department and the foreign ministry of the other country. These agreements are fairly standard. They contain a recital of the mutual defense interest and an understanding of the responsibility of each government as a recipient of classified information. They agree to:

- Afford the information substantially the same degree of protection afforded it by the releasing government.
- Not use the information for a purpose other than that for which it was released.
- Not release the information to a third government without the approval of the releasing government.
- Respect private rights, such as patents, copyrights, or trade secrets, involved in the information.

General agreements, as their name implies, do not contemplate the exchange of any specific type or quantity of classified information. They are meant to provide the security assurances for an exchange when the governments decide to do so. For the most part, they do not specifically envision an exchange of classified military technology.

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When the United States and a foreign government contemplate a relatively extensive exchange of classified military technology for use by industry, the general agreement is amplified by a separate industrial security agreement. These agreements are drafted by the Office of the Deputy Assistant Secretary of Defense for Security Policy which also participates in their negotiation. These agreements are concluded between the Secretary of Defense and the defense ministry of the foreign government. It should be emphasized that they are meant to augment general agreements and are only used where general agreements already exist.

Industrial security agreements cover in some detail the principal security measures applicable in protecting information incidental to classified work undertaken in industry in either country. These include provisions for clearance of facilities and individuals by each country, handling and transmission of classified information, and procedures for visits involving the exchange of classified information. The provisions of industrial security agreements are in consonance with the procedures of the Industrial Security Manual for Safeguarding Classified Information and the DOD Industrial Security Regulations.

There are at present industrial security agreements with Australia, Canada, the Federal Republic of Germany, the Netherlands, Sweden, Switzerland, and the United Kingdom.

In some instances, because of legal or security considérations, the State Department is unable to negotiate a satisfactory general security agreement with a foreign government, but the defense ministry of that government is able to offer satisfactory guarantees that U.S. classified information transferred to it will be adequately protected. In such a case, a special security agreement is negotiated between the U.S. Defense Department and the defense ministry of the foreign government. In practice, these agreements are limited in scope and usually involve information of relatively low degree of sensitivity relating to defense material which has been sold to that country in furtherance of U.S. defense interests.

Each special agreement is tailored to meet the particular security conditions of the foreign government and, at the same time, to satisfy U.S. security requirements. In contrast, general security agreements, and industrial security agreements which supplement them, are drawn on the assumption that the foreign government operates a security system which, though differing in detail, is roughly parallel to that of the United States.

As in the case of industrial security agreements, special agreements are drafted for DOD by the Office of the Deputy Assistant Secretary of Defense for Security Policy, which also participates in their negotiation. Usually, the request for the agreement comes from a DOD staff element which has determined that the release of certain classified information to the foreign government would be in the best interests of the United States.

It should be noted that, prior to or during the negotiations of the bilateral agreements, the United States conducts a survey of the security procedures of the foreign government involved to determine whether it has the capability of safeguarding U.S. classified information. If serious deficiencies are noted, the foreign government is informed of the corrective action required. Almost invariably foreign governments have been cooperative in taking necessary remedial action.

If the exchange of information extends over a long period, each country may send inspection teams to the other to ensure compliance with the terms of the agreement. The frequency and extent of these inspections is dependent on the amount and sensitivity of the information exchanged.

Foreign classified information released to the United States under bilateral agreements is protected by Executive Order 10501. Each department or agency in the Executive Branch which receives such information makes provisions for appropriate protection. Within the Defense Department, DOD Directive 5200.1 provides that such information will be afforded the same protection as is afforded to U.S. information of equivalent level. For example, Confidential information received from the United Kingdom is protected in the same manner as U.S. Confidential.

There are no fixed exchange channels for classified information transferred under bilateral agreements. The channels are usually determined by the nature and extent of the exchange involved, but the actual exchanges occur where there is an appropriate interface of the defense staffs of the two governments. One rule, however, governs all exchanges of classified information. The exchange may take place on a government-to-government basis only. No industrial facility or employee of a facility in one country may receive classified information directly from another country.

There are no additional clearance requirements for access by U.S. personnel to such foreign classified information. A U.S. employee holding a clearance for U.S. Confidential is eligible, provided he has a need to know, for access to foreign Confidential information exchanged through a bilateral agreement.

There is no requirement from a security standpoint that foreign classified information be handled and stored separately from U.S. classified information. Both types of information may be merged into a single file if desired for convenience or ready reference.

Bilateral agreements provide the protective framework for the sale by the United States of classified military equipment. They also make it possible for foreign governments to purchase classified material from U.S. contractors. Finally, and perhaps most importantly, they enable U.S. and foreign contractors to combine their classified technology in the interests of the national defense of the countries involved.

Multilateral Agreements

Multilateral agreements are concerned with protecting information contributed by the United States and other nations as participants of the North Atlantic Treaty Organization (NATO), the Southeast Asia Treaty Organization (SEATO), and the Central Treaty Organization (CENTO). Although not a member of the Central Treaty Organization, the United States does participate in many of its activities.

All of these organizations were cre-

ated because of recognized need for a common defense effort on the part of the participating nations. A common defense effort implies a sharing by the participants of classified defense information. Each of these treaty organizations contain specific provisions for the protection of classified information placed in the organization.

The instructions of each of these three treaty organizations require that each member nation designate a National Security Authority who will be responsible for the security of all classified information of the treaty organization within each respective national jurisdiction.

In the United States, the Secretary of Defense has been designated as the National Security Authority for NATO, SEATO, and CENTO affairs. This authority, except for a few particulars, has been delegated to the Deputy Assistant Secretary of Defense for Security Policy.

The U.S. National Security Authority has responsibility for the security of all treaty organization classified information within the United States. He is required to promulgate security instructions to implement the security instructions of each treaty organization. These instructions for safeguarding classified information are effective throughout the Executive Branch of the U.S. Government. The instructions are drafted by the Office of the Deputy Assistant Secretary of Defense for Security Policy. Implementing procedures for each of the three treaty organizations are signed by the Secretary or the Deputy Secretary of Defense.

The Deputy Assistant Secretary of Defense for Security Policy, acting for the National Security Authority, is responsible for coordinating and presenting the U.S. position on measures affecting the protection of classified information within each of the treaty organizations. He must, as far as possible, ensure that the international organization has stringent rules to protect U.S. classified information and that of other participating nations, without impeding the flow of such information to its intended recipients.

Each treaty organization has a registry system for the transmission of its own classified information. The systems are designed to provide accountability for sensitive information and to restrict access to properly cleared persons. Each participating nation and major element of the three treaty organizations must maintain a NATO, SEATO, and CENTO Central Registry and a network of similar transmission units called subregistries and control points. Except for material sent to U.S. contractors, all NATO, SEATO, and CENTO classified information is transmitted through the registry channels.

In the United States, the focal point for treaty organization registry systems is the Central United States Registry (CUSR), operated by the Office of the Adjutant General, Department of the Army, as executive agent for the U.S. National Security Authority for NATO, SEATO and CENTO. The Deputy Assistant Secretary of Defense for Security Policy has the responsibility for staff supervision and inspection of the CUSR.

Although it is a single agency, the CUSR maintains the NATO, SEATO and CENTO organizational registries as separate entries. The CUSR establishes subregistries and control points as needed by the various departments and agencies of the Executive Branch. It should be emphasized that, while the CUSR establishes subregistries and control points, the operation and control of the latter is the responsibility of the departments and agencies in which they are established. The CUSR does, however, conduct an annual inspection of most U.S. subregistries worldwide to ensure compliance with the instructions of the U.S. Security Authority. Excepted are the subregistries in U.S. embassies outside the United States, which are inspected by the Department of State.

One aspect of U.S. relationship with NATO deserves special mention. The United States releases a limited amount of Restricted Data and Formerly Restricted Data to NATO. This information is subject to even stricter control than other classified information of the same classification level. NATO has a separate registry system for its receipts and transmissions, and each registry, subregistry and control point in the system must maintain access lists of persons authorized to receive this information. In addition, the Defense Department and the Atomic Energy Commission conduct inspections of NATO elements and NATO member nations holding such information.

The contrast between the security procedures in the multilateral agreements and those in the bilateral is rather striking, although in practice the protection afforded to the information exchanged differs very little.

Multilateral exchanges in the treaty organizations require special channels of transmission, special clearances for access, and periodic inspections. In a bilateral exchange, each country agrees to protect the others' classified information in substantially the same fashion as its own.

In bilateral exchanges, each recipient incorporates the foreign information received into its own classified holdings. In multilateral exchanges with treaty organizations, the pooled information is maintained separately and protected in accordance with the security instructions of the treaty organization. It must be remembered that the international treaty organizations have no classified information of their own. They are dependent on a common fund of classified information. In order to induce the participating nations to release their classified expertise, there must be provided a rather formally structured system giving reasonable assurance of protection.

The practice of exchanging classified information with other governments needs no justification. In general, it has served to improve the defense posture both of the United States and those nations with whom the information has been shared. It has avoided duplication of research and production costs by disclosing to participating nations either the existence of desired defense materials or the technology to produce them. While it has not removed the barriers that surround both the secrets of the United States and those of its allies, it has established carefully controlled conduits through which selected elements of classified information may flow from one government to another in the interests of mutual defense.

The ability of the United States to exchange classified information is based on its ability to protect the classified information received and to assure the protection of information released.

Army Tank-Automotive Command

Development and Acquisition of Tactical and Combat Vehicles

Major General Shelton E. Lollis, USA

A shared responsibility, in every sense of the expression, describes the relationship of the U.S. Army Tank-Automotive Command (TACOM) with both large and small industry.

TACOM, a subordinate command of the Army Materiel Command (AMC), is housed at the Detroit Arsenal, in Warren, Mich., a suburb 17 miles northeast of Detroit.

The mission involves research, engineering, development, procurement, repair parts supply, operational training and maintenance support, associated with the wheeled and tracked tactical and combat vehicles used by all the military services.

TACOM is the Army's worldwide manager of tactical vehicles and selected combat vehicles, and the repair parts peculiar to those vehicles. This worldwide inventory, valued at $3.5 billion, includes about 50,000 different automotive parts for a fleet of 535,000 tactical vehicles.

In addition, TACOM supports other AMC commands, military services, and foreign military assistance and sales programs which involves about 500,000 vehicles. The magnitude of the TACOM mission is both imposing and challenging. Obviously, it is a mission that leans heavily on the unyielding support of private enterprise.

As an oversimplification of the case, it can be said that TACOM establishes production requirements and production standards. Private manufacturers address their production know-how to the problem of fulfilling those requirements.

TACOM has 10 directorates and several operational offices within the command organization structure. Each of these elements contributes to the total product. Some of them deal only with internal activities, while others are concerned with such exclusively Army matters as the ordering and moving of supplies.

To develop a complete and accurate picture of how the TACOM-industry interplay collectively keeps the supply line filled with top quality material, let's examine more closely those operating elements that are associated with industry in their day-to-day efforts.

Laboratories

It all begins in the laboratories. Research, test, and evaluation programs in advanced vehicles, mobility and propulsion systems, components and materials, and physical sciences related to tank-automotive materiel are planned and performed by the laboratories, or appraised by the laboratories in the case of contracted programs.

Five TACOM laboratories—Advanced Systems, Mobility Systems, Propulsion Systems, Vehicular Components, and Materials and Physical Science—support the command's current development and production programs in mobility and propulsion systems and in components and materials applications.

The Advanced Systems Laboratory develops and prepares long range vehicle systems concepts based on logistical and tactical patterns for the anticipated character of the Army's future needs.

Translating the soil mechanics effort in ground strength and terrain-vehicle interactions into vehicle design is one of many jobs performed by the Mobility Systems Laboratory. Other functions include performing vibration research, making analytical predictions of vehicle performance, and defining vehicle ride dynamics.

TACOM's Propulsion Systems Laboratory is the principal engine-power train organization in the Army. Operating extensive test and experimental facilities, the laboratory uses automatic computerized instrumentation and control equipment in performing field simulation tests. Its staff pursues comprehensive programs on fuels, combustion research, filters, and lubricants engineering studies.

Supporting extensive programs in

Major General Shelton E. Lollis, USA, has been Commanding General, Army Tank-Automotive Command, Warren, Mich., since October 1967. Prior to this he served as deputy and then commanding general, First Logistical Command, Vietnam. General Lollis holds a bachelor's degree in electrical engineering from the University of Oklahoma.

materials behavior in stress and extreme environments is the primary responsibility of the Vehicular Components and Materials Laboratory. In this facility, physical, chemical, mechanical, electrical, radiographic, and metallurgical investigations are performed in connection with all engineering programs. The laboratory assists in solving manufacturing and processing problems for vehicle components.

Long range scientific problems that relate to the other laboratories is the full time objective of the scientists assigned to the Physical Science Laboratory. The main inhouse program of this group is the identification and control of the entire range of vehicle signatures, including infrared, sonic, seismic, and magnetic.

TACOM's laboratory complex works closely with the Development and Engineering Directorate to fit power trains and basic component subsystems into vehicles on predetermined time cycles that conform to end item commitment dates. The laboratories, in their effort, are guided by the constraints of stringent military requirements for top quality vehicles of varying power ranges and weight classes that will operate effectively in all field environments.

The scientific-engineering challenge at TACOM is supported by industry with contracts for hardware and services. But the increasing number and complexity of problems associated with providing and maintaining today's vehicle fleet are placing expanded demands on the Army-industry team. Current cost figures indicate that the ratio of operating costs to acquisition costs is approximately three to one.

To achieve a proper balance between cost factor and adequate defense posture, the most effective management techniques are employed in determining how many research and development dollars will be allocated to acquisition or long range research and development objectives, and how many will be devoted to current or operational research and development efforts.

Development and Engineering

The Development and Engineering Directorate provides engineering services from "cradle to the grave." Once the user requirements are known and begin to harden through the process of the qualitative materiel requirement, the primary involvement of this directorate begins.

This TACOM organizational element is responsible for the direction of development and engineering through concept, engineering development, advanced production engineering, and support to production and out-of-production systems. In support of that broad mission, we may fabricate inhouse concepts or pilot systems. We support international programs, including data exchange agreements and co-production. Also, inherent in the mission of the Directorate of Development and Engineering is the planning and direction of safety, reliability and value engineering efforts which are integral to the overall engineering of vehicle systems. The directorate also has responsibility for direction of engineering development of diagnostic systems used in support of internal combustion engine equipment.

To support the Director of Procurement and Production, the Development and Engineering Directorate provides technical data packages for procurement of both major and secondary items. This package includes transportability engineering requirements and packaging data. Engineering change orders are developed and released to correct "no fit" conditions or drawings and specifications that are found to be in error as a result of production experience. Rebuild specification and wear limits are established in support of depot rebuild, and field maintenance programs are provided to the Maintenance Director for his inclusion into maintenance and rebuild technical publications.

Engineering investigations and evaluations are conducted on equipment improvement reports from the field. In the event a modification requiring engineering support is necessary, the Development and Engineering Directorate provides assistance. It participates in trial installations and monitors test results prior to the release of a Department of the Army modification work order.

Unsolicited proposals received from industry are reviewed and evaluated to determine their merit and value in the military environment.

Using a portable crane, model makers of the TACOM Development and Engineering Directorate assemble mock-up by fitting cupola into the hull.

Invitations for bids are prepared in conjunction with the Procurement and Production Directorate relative to advance production engineering. Production engineering contracts are awarded and renewed on an "as required" basis to provide industry support to military ground mobility equipment.

Maintenance

The Maintenance Directorate serves as TACOM's national maintenance point and plans, directs and manages the National Maintenance Engineering Program for tank-automotive equipment from concept through obsolescence. Among responsibilities of the Maintenance Directorate are determination of maintainability and development of maintenance support plans for all newly designed material.

The national maintenance point effort covers two basic functional areas: maintenance engineering pro-

grams which influence vehicle design, and field maintenance policy. This includes solving user problems, provisioning for vehicle fleets and other software associated with fielding a piece of equipment.

Maintenance technicians work directly with production engineering contractors to establish a final list of repair parts to support new vehicles. Through review of drawings, repair parts, and vehicles, they determine the interchangeability and standardization of parts, recommending to the contractor various modifications to parts already in the supply system that can do the same job without adding a new part to the system.

In addition, the Maintenance Directorate oversees preparation, development, and dissemination of all source data for Department of the Army equipment publications in the tank-automotive field. Ninety percent of the manuscripts are prepared by production engineering contractors developing the vehicles since they have the necessary data (drawings, parts and vehicles) readily available. Guidance is furnished to the contractors in preparing manuscripts, both technically and editorially. All manuscripts are reviewed for accuracy by the Maintenance Directorate at several points.

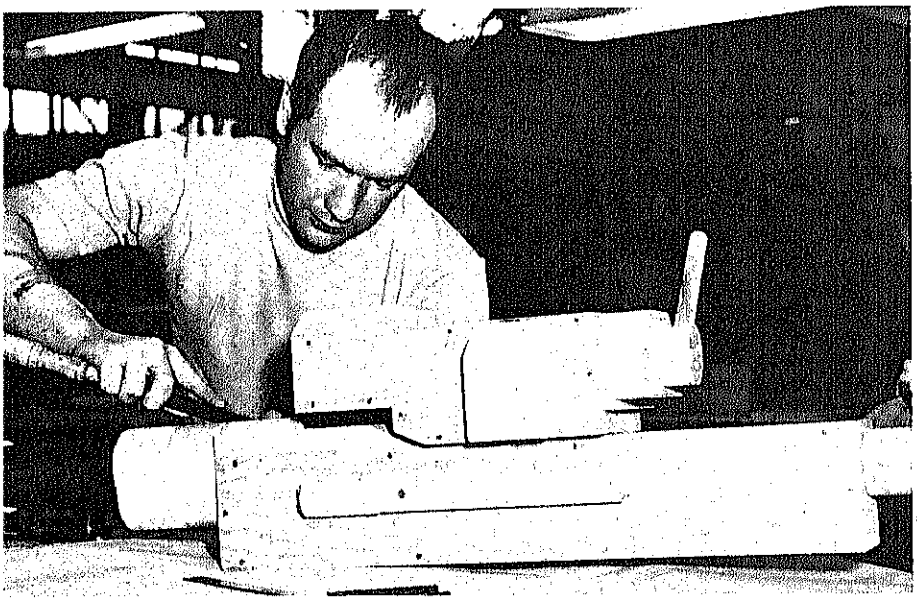
Introduction of newly developed equipment necessitates instruction of key military and civilian personnel in its maintenance and operation. This is accomplished by a Liaison and Training Division shortly after manufacture of early pilot models. Personnel completing the initial course of instruction return to their organizations and formulate courses of instruction to be taught in the military service schools. The program is scheduled so that graduation of the first class from the service schools is concurrent with delivery of the equipment to the user.

Technical assistance to all U.S. military forces and Military Assistance Program countries is provided on an "as required" basis by TACOM maintenance technicians stationed throughout the world.

A great amount of the functional effort of the maintenance mission is through contracts with industry. Industry performs a diversity of tasks from key punching cards to rebuilding tanks and trucks.

To maintain peak efficiency in performing its mission the TACOM Maintenance Directorate relies on the support of industry and major attention is directed to improving lines of communication with industry to eliminate any element of doubt that the support exists and is productive.

A model pattern maker works on mockup of a 20mm gun, a function of the TACOM Development and Engineering Directorate.



Procurement and Production

Located at the Michigan Army Missile Plant, five miles from the TACOM headquarters complex, the Procurement and Production Directorate is the national procurement point for the commodities managed by the command.

The directorate is responsible for an annual procurement program of close to $1 billion.

A steady stream of qualitative information pours into the procurement machinery—requests for inclusion on the TACOM bidders' list, responses to solicitations, requests for clarification of solicitations or specifications, value engineering proposals, reports of pre-award surveys, audit reports, etc.

One of the more important sources of information and help is the TACOM small business advisor. Through him, various ways are found of furthering the expressed desire of Congress that small business firms obtain a fair share of DOD procurement dollars.

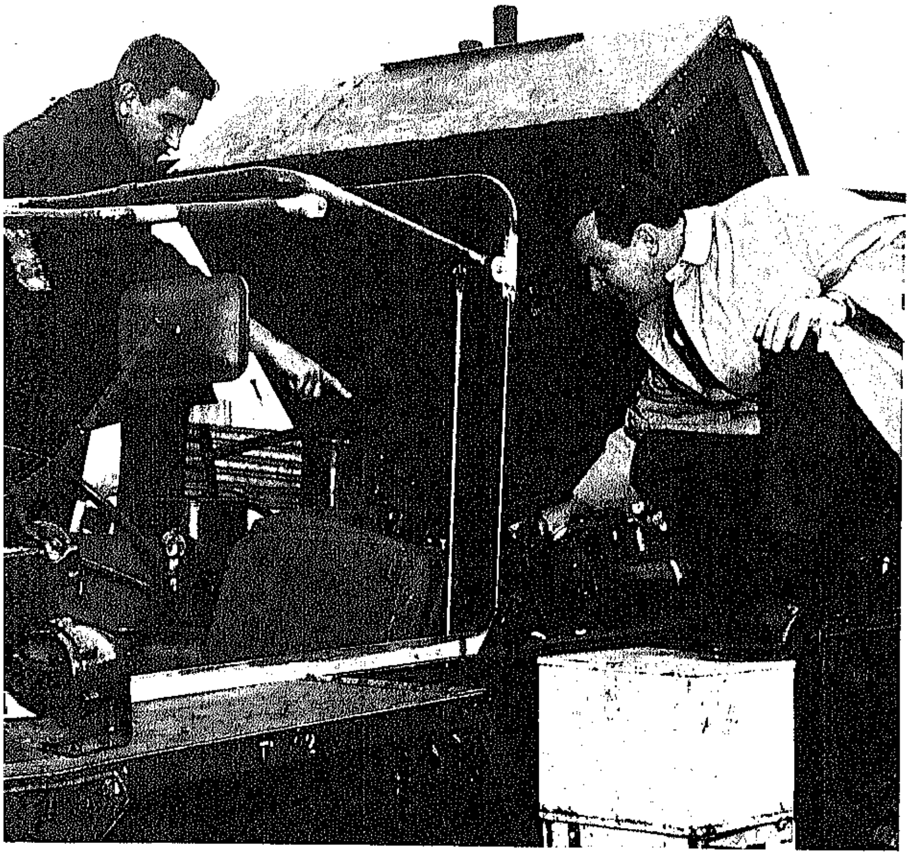
Quality Assurance

As the name of the organization clearly indicates, the purpose of the Quality Assurance Directorate is to confirm that the quality designed into the product actually exists when it is delivered into the inventory. Every function of the five divisions within the directorate is related directly or indirectly to this objective.

A staff of quality assurance engineers assess vehicles and components throughout their life cycles and in this way establishes reliability and maintainability parameters.

Data relating to tests, performance, field environment, deficiencies, down time, and many other important factors are collected and analyzed. The results are passed along to the other operating directorates to assist them in decision-making processes that deal with cost reduction, product improvement, and increased product reliability and maintainability.

Specific responsibilities of the directorate include inspecting engineering contractors, vehicle acceptance inspection, monitoring vehicle tests, and furnishing technical assistance to contractors or other DOD agencies.



Getting right into their jobs of evaluating components of the M561 vehicle are key inspectors of the TACOM Quality Assurance Directorate.

The quality assurance function has become increasingly important over the years. The government's role has changed from physically inspecting items produced by contractors to a quality assurance function. The current environment requires monitoring and approving contractors' systems to assure appropriate controls for inspection and acceptance of items produced for the Government.

Combat readiness in the name of national defense means troops with the most modern equipment, free of defects and instantly available to do the job for which it was designed.

In the case of TACOM, the equipment involved is tracked and wheeled vehicles and their repair parts. TACOM, in doing its job, can measure its effectiveness in terms of the effectiveness of its working and continuing relationship with its partners, both large and small, in industry.

Weather Reconnaissance System Contracts Awarded

Two $300,000 contracts for definition studies on the Airborne Weather Reconnaissance System (AWRS) have been awarded by the Air Force Systems Command's Electronic Systems Division (ESD), L. G. Hanscom Field, Bedford, Mass. Selected from among six bidders were General Dynamics Electronics Division, San Diego, Calif., and Kaman Corp., Bloomfield, Conn. Upon completion of the definition, a single company will be chosen for the acquisition contract.

Combining both off-the-shelf and newly developed sensors, the system when operational will provide the Air Weather Service of the Air Force with a substantially increased capability to collect, process and relay weather data to selected ground stations on a global basis. The program was recently reoriented to emphasize tropical storm reconnaissance after Hurricane Camille.

AWRS is being acquired by the ESD Aerospace Instrumentation Program Office.

Emergency Flight Control Power Package Tested

An emergency aircraft control hydraulic power package is being flight tested by the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio.

Called a Simplex Integrated Actuator Package, it is part of a survivable flight control system, combining power-by-wire with fly-by-wire.

A high performance aircraft cannot be controlled without hydraulic power. Therefore, a pilot usually must eject from his aircraft when his central hydraulic system fails because of malfunction or battle damage. With the emergency system, a pilot has power for nearly two hours to fly home and land after his central hydraulic system has been knocked out.

The emergency system consists of an electric motor driven hydraulic pump and a hydraulic reservoir. The Simplex system also provides standard flight operating performance while powered by the aircraft's central hydraulic system.

Flight tests conducted in a modified YF-4E Phantom II aircraft have shown that the emergency hydraulic system has performed beyond the original limits set for the required get-home-and-land capability. In a number of simulated inflight central system failures, the system provided power to the stabilator (horizontal tail) within one-half second. System temperature is critical, since hydraulic lines are not cooled by running them through the fuel tanks. During flight tests, however, the temperature remained below 275 degrees Fahrenheit.

Flight endurance of the pump was satisfactory and power was more than adequate. The Simplex System was developed by LTV Electrosystems of Dallas, Tex.

The survivable flight control system is under development by McDonnell Douglas Corp. Purpose of this program is to replace long hydraulic lines and mechanical linkages running through an aircraft with redundant dispersed wires which carry electrical signals from the pilot to the actuator packages.

GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from:
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402.

Effect of Value Engineering Changes on Reliability of Equipment in Service. Reports on a study made to determine the impact of Value Engineering (VE) changes on the reliability of in-service equipment. VE definition, VE policies, approval of VE changes, and performance and payment of VE are discussed. Recommendations included. 1970. 74 p. D7.2:V 24/3. 70¢.

DSA Equal Employment Opportunity, Affirmative Action Plan. Constitutes the Equal Employment Opportunity Affirmative Action Plan for the Defense Supply Agency. 1970. 20 p. D7.6/7:1400.2. 30¢.

U.S. Foreign Assistance in the 1970s: A New Approach. Report to the President, covers foreign economic and military assistance programs and provides recommendations and conclusions. By the Task Force on International Development. 1970. 39 p. Pr37.8:In 8/F 76. 30¢.

Improving the Prospects of Small Business. This report by the President's Task Force presents an overview of the problems faced by small business today, considers the problems of the future, and recommends what might be done to enhance small business prospects in this country. 1970. 30 p. Pr37.8:Sm 1/R 29. 25¢.

The Next Decade in Space. A Report by the Space and Technology Panel of the President's Science Advisory Committee. 1970. 63 p. PrEx8.2:Sp 1. 65¢.

Classification System for Indirect Costs of Defense Contractors in the Aircraft Industry. 1970. 134 p. il. D305.2:C 53. $1.25.

Manual for Standard Data Elements, DOD Data Elements Standardization Program. March 1, 1970. 483 p. D1.6/2:D 26. $7.00.

DEFENSE PROCUREMENT CIRCULARS

Distribution of Defense Procurement Circulars is made automatically by the U.S. Government Printing Office to subscribers of the Armed Services Procurement Regulation (ASPR).

Defense Procurement Circular No. 80, June 22, 1970. (1) Memorandum from the Assistant Secretary of Defense (Installations and Logistics). (2) Preparation, Storage, and Intra-Area Movement of Personal Property, ASPR Section VII, Part 16. (3) Automatic Data Processing Equipment (ADPE) Leasing Policies and Practices of Defense Contractors. (4) Requirement for Reidentification of Contracts Not Identified in Accordance with ASPR Section XX. (5) Revision of ASPR Section XXI—Effective for FY 1971. (6) Reporting and Controlling Industrial Plant Equipment.

Defense Procurement Circular No. 81, August 21, 1970. (1) Instructional Material and Clauses for Inclusion in Contracts to be Performed in RVN. (2) Provision to be Included in Solicitations for Fixed Price Contracts to be performed in Vietnam. (3) Special Notice to Purchasing Offices Executing Contracts for Performance in Vietnam. (4) Bid Opening Time. (5) Procurement Involving Work to be Performed in Foreign Countries. (6) Restriction on Independent Research and Development (IR&D), Bid and Proposal (B&P) and Other Technical Effort (OTE). (7) SBA Certificates of Competency—ASPR 1-705.4 (2) Price Representation in Procurements of $100,000 or Less. (9) Revision to Section XX, Part 3.

Defense Procurement Circular No. 82, August 25, 1970. (1) Equal Employment Opportunity.

RESEARCH REPORTS

Organizations registered for service may obtain microfiche copies of these documents without charge from:
Defense Documentation Center
Cameron Station
Alexandria, Va. 22314
All organizations may purchase microfiche copies (65¢) or full-size copies ($3) of the documents (unless otherwise indicated) from:
Clearinghouse for Federal and Scientific Information
Department of Commerce
Springfield, Va. 22151
All orders to the Clearinghouse must be prepaid.

New Infrared Detector Using Microwave Techniques. P. A. Locke and H. Jacobs, Army Electronics Command, Fort Monmouth, N.J., June 1970, 21 p. AD-706 826.

Pressure Measurements on Four Cone-Cylinder-Flare Configurations at Supersonic Speeds. W. D. Washington and J. A. Humphrey, Army Missile Command, Huntsville, Ala., Oct. 1969, 279 p. AD-699 359.

The Design and Dynamic Balancing of Spinning Models and a Testing Technique for Obtaining Magnus Data in Wind Tunnels. A. S. Platou et al., Army Aberdeen Research and Development Center, Aberdeen Proving Ground, Md., Oct. 1969, 38 p. AD-699 803.

Thermospline: A Program for Computing the Thermodynamic Properties of Steam. C. Ash and J. W. Schot, Naval Ship Research and Development Center, Washington, D.C., Feb. 1970, 82 p. AD-704 089.

Improvement of the Useful Temperature Range of Rubber Shock Mounts. J. D. Ruby, Army Weapons Command, Rock Island, Ill., Feb. 1970, 25 p. AD-703 875.

Medium Strain Rate, Tensile Testing of Selected Plastic Materials. F. P. Stecher, Naval Ordnance Labora-

tory, White Oak, Md., July 1969, 48 p. AD-701 318.

Chemical Vapor Deposition of Polycrystalline Aluminum Oxide. P. Wong and M. Robinson, Army Materials and Mechanics Research Center, Watertown, Mass., Oct. 1969, 17 p. AD-701 013.

Thermodynamic Properties of Ternary Refractory Carbides, Part I: Zirconium-Niobium-Carbon. C. K. Jun and M. Hoch, Air Force Materials Laboratory, Wright-Patterson AFB, Ohio, Dec. 1969, 40 p. AD-700 765. Also **Part IV: Relations Between Thermodynamic Properties, Bonding, and Compressibility.** M. Hoch and S. Yamauchi, 22 p. AD-700 766.

Development of Compressive Surface Stresses in Slip-Cast Fused Silica. P. A. Ormsby, Army Missile Command, Redstone Arsenal, Ala., June 1969, 60 p. AD-699 815.

Fluerics 28: State-of-the-Art 1969. J. M. Kirshner and R. Gottron, Harry Diamond Laboratories, Washington, D.C., Dec. 1969, 38 p. AD-703 117.

Directory of Points of Contact: Research and Development, Washington, D.C. P. C. Daniels, Office, Chief of Research and Development (Army), Washington, D.C., Apr. 1970, 46 p. AD-704 945.

Use of Atomic Absorption Spectrophotometer for Analysis of Cement. H. H. Chang, Army Engineer Waterways Experiment Sation, Vicksburg, Miss., Mar. 1970, 32 p. AD-704 956.

Ground Effects Machines (GEM). Defense Documentation Center, Alexandria, Va., April 1970, 191 p. AD-704 800.

Manufacturing Methods of Composite Materials. Defense Documentation Center, Alexandria, Va., Feb. 1970, 66 p. AD-701 500.

Cargo Ships. Defense Documentation Center, Alexandria, Va., May 1970, 90 p. AD-705 950.

Lubricants for Use in the Space Environment. Defense Documentation Center, Alexandria, Va., Mar. 1970, 116 p. AD-702 550.

NRL-MB-20B: An Improved Instrument Ball Bearing Lubricant. C. H. Blachly et al., Naval Research Laboratory, Washington, D.C., Mar. 1970, 14 p. AD-704 466.

Prime Contract Awards By State

Military procurement from contractors within the United States totaled $33.6 billion in fiscal year 1970, $5.7 billion less than in FY 1969. This reduced volume impacted on three-fourths of the individual states as dollar-volume declines ranged from a high of $1.0 billion in California, principally the result of reduced aerospace contracts, to a low of $2 million in Maryland.

In addition to California, nine other states were also substantially affected by declining aerospace contracts: Texas, Ohio, Pennsylvania, Connecticut, Massachusetts, New Jersey, Illinois, Missouri and Washington.

Although California reflected the largest dollar volume decline, it again ranked first in military prime contract awards received, as its proportion of total awards rose slightly to 19.6% compared with 19.4% in FY 1969. New York, which had ranked third during the past three years displaced Texas in second position as the dollar volume of contracts awarded in New York remained stable thereby resulting in a proportional increase to 10.3% of total compared with 8.7% last year.

In contrast with the majority of states there were 11 states with increased dollar volumes. Of these, Mississippi and North Dakota had substantial increases reflecting, for Mississippi, a large shipbuilding contract and for North Dakota, a construction contract in support of the Safeguard Missile Program.

Source: Directorate for Information Operations
Office of Assistant Secretary of Defense
(Comptroller)
August 27, 1970

Notes on Coverage

It is emphasized that data on prime contracts by state do not provide any direct indication as to the state in which the actual production work is done. For the majority of contracts with manufacturers, the data reflect the location of the plant where the product will be finally processed and assembled. If processing or assembly is to be performed in more than one plant of a prime contractor, the location shown is the plant where the largest dollar amount of work will take place. Construction contracts are shown for the state where the construction is to be performed. For purchases from wholesale or other distribution firms, the location is the address of the contractor's place of business. For service contracts, the location is generally the place where the service is performed, but for transporation and communications services the home office address is frequently used.

More important is the fact that the reports refer to prime contracts only, and cannot in any way reflect the distribution of the very substantial amount of material and component fabrication and other subcontract work may be done outside the state where final assembly or delivery takes place.

The report includes definitive con-
(Continued on page 18.)

PRIME CONTRACT AWARDS BY STATE

Net Value of Military Procurement Actions by Fiscal Year [a]

Fiscal Years 1967, 1968, 1969 and 1970

(Amounts in Thousands)

State	Fiscal Year 1967		Fiscal Year 1968		Fiscal Year 1969		Fiscal Year 1970	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
TOTAL, U.S.[b]	$41,817,093		$41,241,125		$39,310,186		$33,569,748	
NOT DISTRIBUTED BY STATE [c]	4,435,384		3,992,991		4,061,395		3,793,119	
STATE TOTALS [d]	37,381,709	100.0%	37,248,134	100.0%	35,248,791	100.0%	29,776,629	100.0%
Alabama	297,065	0.8	409,189	1.1	407,726	1.2	315,941	1.1
Alaska	85,648	0.2	106,513	0.3	90,793	0.3	76,285	0.3
Arizona	249,559	0.7	287,065	0.8	343,730	1.0	277,062	0.9
Arkansas	127,180	0.3	121,264	0.3	117,179	0.3	69,823	0.2
California	6,688,812	17.9	6,471,875	17.4	6,824,493	19.4	5,823,799	19.6
Colorado	210,409	0.6	262,763	0.7	248,237	0.7	217,528	0.7
Connecticut	1,935,895	5.2	2,355,135	6.3	1,715,115	4.9	1,237,564	4.2
Delaware	51,672	0.1	42,614	0.1	46,762	0.1	21,613	0.1
District of Columbia	367,666	1.0	349,771	0.9	321,014	0.9	316,109	1.1
Florida	799,005	2.1	975,824	2.6	964,541	2.7	848,750	2.9
Georgia	1,148,355	3.1	964,152	2.6	932,881	2.6	948,974	3.2
Hawaii	65,445	0.2	95,623	0.3	114,608	0.3	109,062	0.4
Idaho	14,772	*	17,051	*	16,054	0.1	10,856	*
Illinois	1,063,776	2.8	932,111	2.5	932,495	2.6	721,277	2.4
Indiana	898,247	2.4	1,107,453	3.0	1,058,557	3.0	906,199	3.0
Iowa	279,328	0.8	260,980	0.7	202,119	0.6	228,197	0.8
Kansas	398,918	1.1	292,293	0.8	349,667	1.0	230,411	0.8
Kentucky	124,294	0.3	60,366	0.2	59,478	0.2	56,538	0.2
Louisiana	656,031	1.8	460,463	1.2	389,857	1.1	290,335	1.0
Maine	56,558	0.2	75,209	0.2	53,408	0.2	55,907	0.2
Maryland	868,396	2.3	703,514	1.9	731,301	2.1	729,042	2.5
Massachusetts	1,422,272	3.8	1,618,741	4.3	1,549,834	4.4	1,199,813	4.0
Michigan	1,033,706	2.8	796,296	2.1	683,215	1.9	562,786	1.9
Minnesota	650,584	1.7	620,297	1.7	741,169	2.1	604,611	2.0
Mississippi	114,800	0.3	369,249	1.0	218,387	0.6	509,069	1.7
Missouri	2,277,597	6.1	1,356,871	3.6	1,095,418	3.1	898,163	3.0
Montana	78,452	0.2	20,453	0.1	21,959	0.1	24,522	0.1
Nebraska	103,522	0.3	120,401	0.3	101,724	0.3	73,345	0.2
Nevada	29,315	*	17,897	*	27,113	0.1	16,333	0.1
New Hampshire	162,551	0.4	155,995	0.4	102,407	0.3	98,747	0.3
New Jersey	1,234,768	3.3	1,108,440	3.0	1,270,460	3.6	1,007,418	3.4
New Mexico	80,472	0.2	87,214	0.2	96,105	0.3	88,007	0.3
New York	3,261,750	8.7	3,483,780	9.4	3,074,340	8.7	3,075,931	10.3
North Carolina	447,608	1.2	487,259	1.3	514,739	1.5	448,709	1.5
North Dakota	16,729	*	68,072	0.2	35,807	0.1	188,783	0.6
Ohio	1,602,593	4.3	1,640,525	4.4	1,533,016	4.4	1,005,808	3.4
Oklahoma	157,350	0.4	164,944	0.4	173,438	0.5	152,342	0.5
Oregon	99,319	0.3	119,719	0.3	85,921	0.2	90,357	0.3
Pennsylvania	1,649,091	4.4	1,727,314	4.6	1,700,396	4.8	1,174,230	3.9
Rhode Island	198,030	0.5	126,362	0.3	119,268	0.3	93,716	0.3
South Carolina	180,777	0.5	138,027	0.4	172,520	0.5	124,304	0.4
South Dakota	9,486	*	33,585	0.1	3,478	*	10,180	*
Tennessee	538,225	1.5	541,631	1.5	485,629	1.4	399,420	1.3
Texas	3,546,978	9.5	4,087,182	11.0	3,525,165	10.0	2,773,927	9.3
Utah	178,850	0.5	131,172	0.4	157,174	0.4	162,387	0.5
Vermont	100,157	0.3	104,957	0.3	85,445	0.2	43,631	0.2
Virginia	665,376	1.8	692,748	1.9	711,232	2.0	634,298	2.1
Washington	606,114	1.6	529,583	1.4	574,761	1.6	384,042	1.3
West Virginia	141,736	0.4	132,002	0.4	66,863	0.2	45,858	0.2
Wisconsin	383,602	1.0	406,409	1.1	393,646	1.1	371,132	1.3
Wyoming	32,868	0.1	14,851	*	13,207	*	14,493	*

For footnote, see page 13.

*Less than 0.05 percent.

by Department [a]

Fiscal Year 1970

Net Value of Civil Functions Procurement Actions [ae]

Fiscal Years 1967, 1968, 1969 and 1970

(Amounts in Thousands)

Army	Navy	Air Force	Defense Supply Agency	Fiscal Year 1967	Fiscal Year 1968	Fiscal Year 1969	Fiscal Year 1970	
$9,170,416	$10,390,632	$10,386,837	$3,621,863	$819,218	$845,295	$684,776	$622,768	TOTAL, U.S.[b]
989,116	1,128,169	1,009,217	666,617	40,875	44,810	41,727	51,903	NOT DISTRIBUTED BY STATE [c]
8,181,300	9,262,463	9,377,620	2,955,246	778,343	800,485	643,049	570,875	STATE TOTALS [d]
165,984	24,744	63,709	61,554	18,441	21,921	20,296	16,777	Alabama
27,733	3,393	39,892	5,767	2,818	7,250	1,364	2,656	Alaska
123,775	50,640	93,663	8,984	2,742	6,381	275	656	Arizona
29,097	3,098	11,765	25,863	81,658	67,525	50,267	26,068	Arkansas
898,590	2,022,808	2,850,292	557,109	52,991	56,465	53,850	58,906	California
49,722	28,020	124,068	15,723	1,539	3,471	2,616	2,240	Colorado
274,902	559,742	375,684	27,336	7,212	5,761	6,010	5,878	Connecticut
2,863	2,145	2,483	14,122	12,658	6,024	3,929	5,019	Delaware
87,186	171,387	39,223	18,813	1,071	299	1,790	499	District of Columbia
215,483	122,842	470,055	40,370	35,334	30,439	23,654	12,182	Florida
67,679	31,621	812,595	37,079	9,390	15,333	6,432	4,512	Georgia
36,980	39,854	21,296	10,982	244	711	4,338	1,540	Hawaii
1,363	—116	5,406	4,208	19,556	26,290	33,375	32,186	Idaho
339,944	82,750	119,559	179,024	18,046	25,919	29,285	28,699	Illinois
556,197	105,970	197,501	46,531	18,052	21,627	11,127	21,354	Indiana
75,698	26,745	76,670	49,084	14,578	12,705	12,421	5,959	Iowa
105,703	2,562	99,752	22,394	11,611	7,153	9,256	8,565	Kansas
23,437	2,421	5,074	25,606	21,701	19,438	11,378	7,576	Kentucky
84,692	89,427	7,455	117,761	40,600	41,074	25,751	35,501	Louisiana
16,419	30,887	2,004	6,597	1,326	1,087	749	198	Maine
156,711	358,846	187,813	25,672	1,716	4,055	2,308	1,880	Maryland
377,751	371,438	378,853	71,771	2,703	4,879	2,058	2,428	Massachusetts
366,147	40,819	81,757	75,063	10,915	8,050	8,727	7,181	Michigan
176,920	187,244	215,542	24,905	3,902	4,898	5,347	496	Minnesota
8,087	460,220	8,133	32,679	18,300	10,586	9,631	36,791	Mississippi
222,197	441,087	198,459	36,420	30,941	26,417	25,186	13,123	Missouri
11,993	86	8,344	4,099	21,840	52,656	45,139	46,158	Montana
41,695	533	18,647	12,470	6,112	6,860	3,378	3,930	Nebraska
3,503	650	10,587	1,593	17	33	87	49	Nevada
6,067	67,510	9,966	15,204	107	156	288	281	New Hampshire
344,233	352,668	170,102	140,415	2,163	4,388	3,773	5,235	New Jersey
46,997	3,632	30,601	6,777	5,955	9,157	5,755	3,284	New Mexico
562,763	1,775,175	586,161	201,832	8,351	14,726	18,955	10,639	New York
263,852	86,621	23,867	74,369	3,534	8,929	3,286	3,737	North Carolina
142,565	6,388	28,445	11,385	2,151	1,462	2,667	8,255	North Dakota
259,918	243,074	420,815	82,001	12,442	18,639	22,705	25,456	Ohio
22,628	9,819	74,578	45,817	48,773	51,698	34,197	28,906	Oklahoma
6,364	45,500	6,305	32,188	44,354	29,995	15,332	11,991	Oregon
449,346	341,078	239,268	143,638	37,760	30,445	30,072	30,986	Pennsylvania
26,839	53,000	3,571	10,306	574	4,234	4,303	4,165	Rhode Island
32,515	41,399	15,214	35,176	2,571	4,151	3,130	3,943	South Carolina
2,190	112	4,540	3,338	2,249	1,662	1,837	1,898	South Dakota
235,787	35,158	73,998	54,477	14,039	12,141	7,258	4,007	Tennessee
656,715	447,122	1,288,473	381,617	28,817	32,503	26,722	17,451	Texas
20,854	14,361	102,694	24,478	0	25	142	249	Utah
25,952	3,474	13,875	830	90	101	385	1,064	Vermont
205,104	362,024	86,486	30,684	8,764	8,992	3,761	4,306	Virginia
21,876	79,988	239,988	42,240	58,974	54,128	37,457	16,195	Washington
23,784	5,095	710	16,269	24,039	18,937	9,728	10,855	West Virginia
282,562	26,981	24,489	37,100	5,122	4,775	6,203	5,004	Wisconsin
88	21	8,353	6,031	0	34	21	26	Wyoming

tracts and funded portions of letter contracts and letters of intent, job orders, task orders, and purchase orders on industrial firms, and also includes interdepartmental purchases, made from or through other governmental agencies, such as those made through the General Services Administration. The state data include upward or downward revisions and adjustments of $10,000 or more, such as cancellations, price changes supplemental agreements, amendments, etc.

The estimated amounts of indefinite delivery, open-end or call type contracts for petroleum are included in the report. Except for petroleum contracts, the report does not include indefinite delivery, open-end, or call type contracts as such, but does include specific purchases or delivery orders of $10,000 or more which are placed against these contracts. Also excluded from the report are project orders, that is production orders issued to Government-owned-and-operated facilities such as Navy shipyards. However, the report includes the contracts placed with industry by the Government-operated facility to complete the production order.

[b] Includes all contracts awarded for work performance in the United States. The United States includes the 50 states, the District of Columbia, U.S. possessions, the Canal Zone, the Commonwealth of Puerto Rico, and other areas subject to the complete sovereignty of the U.S., but does not include occupied Japanese Islands and Trust Territories.

[c] Includes contracts of less than $10,000, all contracts awarded for work performance in the Commonwealth of Puerto Rico, U.S. possessions, and other areas subject to the complete sovereignty of the U.S., contracts which are in a classified location, and any intragovernmental contracts entered into overseas.

[d] Net value of contracts of $10,000 or more for work in each state and the District of Columbia.

[e] Civil functions of the Army Corps of Engineers for flood control and rivers and harbors work. Civil functions data are shown separately, and are not included in military functions tabulations.

New Architect-Engineer Selection Method Tested

In the interest of enhancing technical competition in procurement of architect-engineer (A–E) services, DOD is considering revising procedures for selecting A–E contractors.

Under the proposed procedures, invitations would be issued to three well qualified firms selected under current procedures. A–E firms would submit competitive technical proposals, accompanied by lump sum price estimates, without price breakdown, in response to the invitation.

A year of tests of the proposed procedures will precede changes to the Armed Services Procurement Regulation (ASPR). Begun in August, the tests are being conducted by the U.S. Army Engineer District, Sacramento, Calif., and the Southern Division, Naval Facilities Engineering Command, Charleston, S.C. The tests apply to A–E awards of $10,000 or more.

Selected A–E firms will be advised that invitations and their proposals are confidential to the Government. They will not constitute a commitment by the Government or the firm. They will not be considered as bids, but simply estimates to accomplish the work as understood by the selected firms.

Price estimates will be kept in sealed envelopes, and will receive secondary consideration after technical evaluations (and rankings) of the proposals have been completed.

It is not anticipated that price estimates will play a predominant role in source selection. The selection board would determine, however, if price considerations would warrant changing relative ranking of the A–E firms.

Negotiations then would be conducted with the selected firm. A contract would be awarded under current procedures.

The extent of detail that an A–E firm submits in his technical proposal would necessarily vary in relation to the nature of the work, monetary value, and complexity of the project. The technical proposal need not provide expensive sketches, preliminary designs, drawings, renderings, or design computations.

Current methods prescribed by the ASPR require a selection board to recommend a minimum of three firms, in order of preference, for approval for contract negotiations, without benefit of technical proposals or price estimates. The proposed method retains technical considerations as the principal factor in making awards. The proposed procedures resulted from a joint review made by the Office of the Assistant Secretary of Defense (Installations and Logistics) and the Military Departments earlier this year.

Army Engineers Establish Advisory Environment Board

An Environmental Advisory Board has been established by the Army Chief of Engineers. Members of the group include:

Dr. Lyton K. Caldwell, professor of political science at Indiana University and author of books and papers on the political and institutional aspects of environmental problems.

Roland Clement, ecologist and vice president of the National Audubon Society, New York City.

Dr. Charles H.W. Foster, executive director, New England Resources Center, Boston; former Commissioner, Natural Resources for Massachusetts; former research associate, Conservation Foundation; member of President Nixon's post-election Environmental Task Force.

Harold Gilliam, author, environmental reporter for the San Francisco *Chronicle*; consultant to various Government agencies.

Richard H. Pough, engineer, conservationist; chairman of the board, Open Space Action Institute, and America the Beautiful Fund, New York; author of several books and articles.

Charles H. Stoddard, environmental consultant and former director, Bureau of Land Management, Department of the Interior; former executive director, Citizens Committee on Outdoor Recreation and Natural Beauty; staff member Resources for the Future, Inc.; consultant; author on conservation and resource management.

FROM THE SPEAKERS ROSTRUM

Interdependence

Excerpts from address by Gen. F. J. Chesarek, USA, Commanding General, Army Materiel Command, Washington, D.C., at Annual Conference of the Armed Forces Management Assn., Los Angeles, Calif., Aug. 20, 1970.

It is one of the truisms of our time that revolutionary developments in communications and transportation have shrunk the globe, with distances between formerly faraway countries being reduced to mere hours of flight time.

Statesmen pay continuous lip service to the axiom that relations among states—even among continents—are interdependence rather than independence. But while every political writer and speaker belabors this point ad nauseam, they actually deal with the Middle East, Latin America, the Atlantic Region, Eastern Europe, Northeast Asia, and Southeast Asia as if we were still living in the World War II era, when time-distance factors made it realistic to speak of a European, an India-Burma-China, a Pacific "strategic theater" as essentially separate and autonomous.

Our foreign affairs people understand the phenomenon of interdependence quite well and are aware that the whole globe has, in fact, become a single strategic theater. In practice, however, management compartmentalization prevents application of theory. For example, those who may be knowledgeable regarding the strategically important Trucial Oman probably know little or nothing about NATO, and those who are experts on Berlin have no interest in Korea.

It doesn't take a lot of imagination, however, to sketch the interconnection of seemingly isolated developments in geographically separated areas into an interconnected mosaic. But unless this is done consciously, no applicable alternatives are invented, much less considered.

General Lyman Lemnitzer, long-time Supreme Commander of Allied Forces in Europe, pondered this same point in a recent address to the graduating class of the Army War College. I quote some of his pertinent observations:

> "First, there is the matter of working effectively with our Allies. I have touched on some of the reasons why Allied cooperation is becoming more and more important—and in some ways, more difficult—than ever before. This importance applies across the entire spectrum of our relations with Allies—from the cooperation of the forces of highly developed nations in a sophisticated military environment, such as the North Atlantic Treaty Organization, to the advisory relationships within developing countries such as those in Southeast Asia.
>
> "In dealing with these intricate matters, it is not enough to master the organization and materiel and doctrine which suit the military temperament and specific needs of *United States* forces. There must also be an understanding of the psychological, technological, and political outlook and capabilities of the people with whom we want to work. This includes an ability to recognize and comprehend *their* objectives, *their* aspirations, and the political, economic, and psychological constraints under which *they* must operate. In brief, the effective senior officer today must have a full and sophisticated understanding not only of the military aspects of strategy, but of the political dimensions of strategy as well."

Gen. F. J. Chesarek

Robert Delaney, President of the Thunderbird Graduate School of International Management, says that:

> "We are entering the post-industrial age. We are moving onto new ground in a world of multi-national techno-economics. Beyond this, and perhaps basic to all of it, is the dramatic influence and persuasive force of the world-wide communications revolution which brings civilizations, cultures, and peoples into direct confrontation for the first time in history.
>
> "This is startling enough

to contemplate. But, accepting this reality and relating it to the organizational forms we have forged to accommodate both the 19th century industrial revolution and the 20th century technological advance, leaves us totally unprepared for the mind-blowing world of tomorrow.

"When one contemplates the cumulative social and economic thrust of computer technology, marketing simulation and game theory, communications satellites, the world information grid, micro- and macro-economics and the development of transnational corporations as well as the development of the third world, you but begin to peek under the tent of business and industry in the seventies and the eighties."

Business management must recognize and prepare for this. Their interests must be integrated with those of their customers, and their organizational structure must be susceptible to integration by some effective mechanism. Functional organizations—the panacea for corporations in the past few decades—are being reexamined critically in business and in schools because of our awareness of the lack of integrative systems short of the top dog. Howard Carlisle, head of the Department of Business Administration at Utah Sate University, in addressing this problem, stated recently that functional organizations tend to emphasize the separate functional elements at the expense of the whole organization and its objectives. He could also have added at the expense of customers, too.

While on the subject of expense, there is a new book on the market titled, "George Washington's Expense Account," by Marvin Kitman. A recently published review by Day Thorpe highlighted the following tidbits.

"When George Washington was elected commander in chief of the Continental Army in June 1775, he declined the proffered salary of $500 a month and delivered the noble words written by his speechwriter, Edmund Pendleton:

'As to pay, Sir, I beg leave to assure the Congress that as no pecuniary consideration could have tempted me to have accepted this Arduous employment (at the expense of my domestic ease and happiness) I do not wish to make any proffit from it. I will keep an exact account of my expences. Those I doubt not they will discharge, and that is all I desire.'

"Eight years later, General Washington turned in his expense account for $449,261.51, an amount which included interest at 6 percent."

I might add that here is probably recorded the first cost overrun—1,000 percent.

"Kitman lists a few of Washington's rules for a model expense account:

'1. Omit nothing. When in doubt, charge anyway. Put it on the train to Westport, and see if it gets off.

'2. Be specific on the smaller expenditures and vague on the larger ones. Describe in some depth the purchase of a ball of twine, but casually throw in the line 'Dinner for one army'.

'3. Whenever possible, intermingle personal and business expenses.

'4. Pick up the check for one's associates. Washington was perhaps generous to a fault in this matter.

'5. Above all be reasonable. Know what the market will bear.' "

* * * * *

Within the Defense establishment, the concept of interdependence of forces in the field has long been recognized and applied, with varying measures of success. We have unified commands with authority to mesh the combat power of all the military services against the enemy.

As an example at a lower level, I never cease to be impressed with the infantry-artillery team where several battalions of artillery concentrate their fires in support of a single infantry maneuvering element. All the liaison, coordination, and communication are done according to a plan. There can be no misunderstanding about who does what or when. The infantry relies on its Red Leg brothers to assist it wherever and whenever the need arises. Field artillery and infantrymen know this is one of the most complex operations they have to handle, and they learn the procedures early in their careers and practice them throughout. It is the application of interdependence at its greatest peak of efficiency during combat with lives at stake.

In the area of Defense management, some work has been under way for years within the various functional areas to reap the fruits of interservice interdependence, but little has been done on a broader front.

The establishment in 1952 of this Association is one tangible example of seeking to exchange knowledge and ideas among Defense managers at all levels and between the military services and our industrial colleagues.

In my view, the potential benefits have not been realized because of too much lip service and too little attention and action. . . . While mouthing the necessity to address our mutual problems on a total systems approach, we proceed too often in exactly the opposite direction.

Interdependence has often been interpreted in military service circles, and also in the business community, as a sort of semantic tactic meaning just the opposie—*total* dependence on someone else, in the same manner that a Communist People's Republic in effect means total authoritarian rule.

Within each military service, simple coordination is both a difficult and time-consuming process between the functional chiefs. While the concept of interdependence is recognized and practiced to some extent, the natural human reaction against dependence on someone else frequently obscures the necessity of interdependence in order to function at all.

In the Army, we created in 1967 the Office of the Assistant Vice Chief of Staff to integrate the efforts of the Army staff functional managers and to act as the program manager for

the Army. In its three years of existence, this office has been perfecting its techniques, so that Professor Carlisle's observation on functional management has been corrected in considerable measure by creation of a bridging mechanism. The bridging mechanism cannot be successful if it functions as a super staff. It must draw on the functional divisions, coordinate and synthesize their work, and by its own analytical and professional expertise produce results which can stand assaults from within and without. This is the application of integration which, in turn, rests upon the conscious understanding of functional interdependence.

* * * * *

Major changes are in the wind. The Defense Blue Ribbon Panel has recently issued its report proposing a revolution in Defense Department structuring, organization, management, and operations. We are facing severe financial restraints and force reductions. The Nixon Doctrine is gradually unfolding, with consequences not yet clearly discernible. The Soviet Union's military strength continues to grow. Our domestic base is in turmoil, with the Defense Department strung up as the whipping boy.

The advent of an era of dramatic change must bring forth a supercharge of adrenalin on the part of managers at all levels to meet the challenge. This is not a time for despair or for marking time until the scene stabilizes. It never will. We need imagination, innovation, initiative, good old American drive, and determination to adjust to changes and to challenge unfounded criticism. We must build on our strengths, overcome our weaknesses, and come out the better for it.

There is only one way this can be done—to pull as a team—to recognize our interdependence on each other and to create a pipeline for ideas and talent to flow both up, down, and laterally.

* * * * *

Gentlemen, no greater opportunity will ever occur to weld Defense management into a cohesive whole. We need only recognize and respond to this fact, and the country and the free world will be our grateful sponsors.

U.S. Army Navigational Requirements

Presentation by Lt. Col. John A. Fambrough, Staff Officer, Hq., U.S. Army Combat Developments Command, Ft. Belvoir, Va., at the Assn. of the U.S. Army Airmobility Symposium, Ft. Rucker, Ala., Aug. 4, 1970.

Lieutenant Colonel John A. Fambrough II is an avionics staff officer in the Electronics Division, Directorate of Materiel, Combat Developments Command, Ft. Belvoir, Va. He has held avionics assignments in Vietnam and with the U.S. Army Electronics Command. He holds a bachelor of science degree from Texas A and I College. He is a graduate of the Army Command and General Staff College.

We are here for the specific purpose of presenting what we in the Army feel are our most urgent navigation requirements, and to solicit industry's support in helping us satisfy these requirements. Note that I said "most urgent requirements." It is not feasible to discuss, or even mention, all of the requirements we have for navigation and positioning equipment. There are in excess of 40 formal requirements documents for navigation position devices.

To illustrate the point that we have far too many requirements for separate systems, the following is a partial listing of Army requirements for navigation position devices:

- Position-Fixing and Navigation System.
- Long Range Position Determining System.
- Survey System, Azimuth Gyro, Lightweight.
- Navigator, Lightweight, Self-Contained.
- Direction and Position Indicating Instrument.
- Navigator, Doppler Radar, Self-Contained.
- Portable Navigation Aid.
- Remote Area Approach and Landing System
- Marine Lighterage Guidance System.
- Position Locator and Navigation Equipment (P).
- Navigation Display for Army Aircraft.

What we are striving for now is a common position and navigation system which will fulfill the great majority of these requirements. In recognition of this requirement, the Department of the Army has established a Project Manager's Office for Navigation and Control Systems at Fort Monmouth, N.J., with responsibility for management of existing and planned tasks to meet:

- Ground, marine and airborne requirements of the Army for position locating (or fixing) and navigation.
- Army requirements for air traffic control in accordance with DOD Directive 5010.14, Army Regulation 70-17, Army Materiel Command Regulation 11-16, and other pertinent regulations.

In addition, the Joint Staff has recently published a Master Navigation Plan which will serve as a guide to the development of future navigation systems. A study of what has been done to fulfill the requirements reveals that considerable effort has been exerted in recent years toward solving

problems of locating and navigating aircraft, and that the efforts to develop a common navigation and position system began in earnest with the development and testing of the Position Fixing Navigation System (PFNS). Although the PFNS was found to be unacceptable for Army use, much valuable information was produced by the tests. This information provides a portion of the data being applied by the Navigation and Control Systems Project Manager toward fulfilling our ultimate objective. That objective is to design a system or systems which will provide instant, continual, and current positioning and navigation information on a worldwide basis for all Army users—ground, marine, and airborne.

We recognize that the current state of the art is not capable of producing a single common tactical navigation system that will fulfill all of the current operational requirements. Therefore, the Army has selected LORAN, a hyperbolic radio system, as the most promising means of satisfying many of the requirements. LORAN is the acronym for long range navigation. This will allow us to field equipment in the near future, while we continue to work on advanced systems which offer us the ultimate capability we are seeking—more sophisticated area navigation systems, such as inertial guidance, and eventually the possible extensive use of satellite navigation systems.

In order to place these requirements in perspective, I have chosen to relate this presentation to an aircraft system which we expect to become operational. The Utility Tactical Transport Aircraft System (UTTAS) is scheduled to replace the UH-1 beginning in the late 1970s. There have been numerous studies conducted to determine what the essential navigation capabilities of the UTTAS should be. We must be realistic in this determination, particularly with respect to cost effectiveness. I don't have to remind you that the Army is going to feel the squeeze of reduced defense spending during the next several years. We are feeling it now.

Consequently, we must define our requirements very carefully, and constantly ensure that research and development dollars are spent wisely.

We are faced with the challenge of providing aviation support during all conditions of weather and visibility that the soldier can fight in, and that remains our ultimate goal.

However, we realize that this goal cannot be fully achieved in the austere budgetary climate we are entering. Therefore, we must develop the best capability possible within the established budgetary limitations. Thus, we have determined that to provide the maximum support under the forecast dollar ceilings, we must have, and can probably afford, to field a fleet of UTTAS with the following navigation systems:

- Low level tactical navigation system.
- Automatic direction finding (ADF).
- VHF/FM homing.
- Complete provisions for omni, glide slope, localizer and marker beacon.

In evaluating these requirements, it is apparent that the most urgent is the development of a navigation system that will provide accurate navigation and position information at all altitudes. In particular, it must provide accurate navigation during nap-of-the-earth operations. This requirement is predicated upon the assumption that in future conflicts, regardless of intensity, Army aviation will be operating in an active air defense artillery environment. We *must* operate at tree-top level because this is the only segment of airspace which affords any degree of protection from radar intercept and vulnerability to destruction by air defense weapons.

We know also that the Army must develop a navigation and position location system for use by ground and marine forces, and for artillery survey purposes.

In consideration of the multitude of requirements for precise navigation and position information in the air and on the ground, the Army has established as its first priority a requirement for a common navigation system which can satisfy a great number of the many requirements. We have determined that the system which can fulfill this requirement in the near future is LORAN.

The next question that occurs is what kind of LORAN. What should it look like? How big? How reliable? How maintainable? What functions? And many other questions.

Unfortunately, this information is not available now because it has not been synthesized from the studies currently underway. We can tell you, however, that we have identified the following general requirements categories for navigation and position fixing:

- Engineering and artillery precise positioning.
- Surveillance and target acquisition positioning.
- Ground mobility navigation and positioning.
- Aircraft navigation and positioning.
- Marine craft navigation and positioning.

In more detail, aircraft navigation and positions requirements are:

- Tactical enroute navigation.
- Position fixing.
- Destination location.
- Let down to attended area.
- Let down to unattended area.
- Civil enroute navigation.
- Civil approach.

The foregoing offers another portrayal of why the Army is seeking a common navigation-position location system. We will be hard pressed to field the equipment in time to meet first UTTAS production. We solicit industry's energetic support and the application of its resources in meeting our milestones.

Current technology is capable of providing the Army with a common navigation and position location system which will greatly enhance military operation in the air, on the ground, and on the waterways. We are looking to industry to provide that technology.

Let us move now to other requirements. First, we need a tactical instrument landing system (ILS) capability. LORAN can provide accurate enroute navigation, but we must be able to execute an approach and landing to a designated landing zone during instrument conditions or during hours of darkness. There are currently several commercial versions of remote area approach and landing systems which meet many of the stated opera-

tional characteristics of the requirement. In addition, the Army Materiel Command has an active program which could provide a remote area approach system by 1974. Essentially, we want a system that provides the following:

- Weight: airborne receiver—20 pounds; ground transmitter — not more than two packages, each not more than 35 pounds.
- Range, glide slope, and azimuth information to permit approach to the ground station from any direction.
- Azimuth lock-on to an aircraft to a range of 10 miles at 200 feet above the ground.
- Glide slope angles selectable between zero degrees to 15 degrees.
- Ground equipment must provide immediate indication of system error or failure.
- High reliability—a mean-time-between-failures of 500 hours.

Automatic direction finding (ADF) will be with us for several years to come. In this area, we are well along toward fulfilling the requirement. The AN/TRN-30 (Tactical/Semi-Fixed Equipment) is expected to be in the field by 1973. We have very high confidence in its ability to fulfill our tactical ADF requirements until the common navigation system is fielded.

Unfortunately, we are not in such a favorable position in the area of FM homing. FM homing will continue to be a requirement for the foreseeable future. FM homing is most advantageous to the Army because our tactical ground radios employ FM, and the antenna weight and cost requirements are low as compared to HF or UHF homing, or ADF antennas. The Army's past experiences with FM homing have not been very gratifying. We have yet to field a system which provides the accuracy and reliability desired. Perhaps the reason for this failing is a result of our attempts to apply one antenna to several types of aircraft. It appears that a concentrated effort in aircraft antenna design and airframe electronic compatibility will be the only way to solve the problems inherent in our present FM homing systems. We are confident that the electronics and aircraft industry can make valuable contributions to this endeavor. We do need industry support in improving the FM homing capability in Army aircraft.

The following UTTAS navigational requirement are those which the Army considers essential:

- Landing assist night vision device.
- Terrain avoidance/terrain following.
- Station keeping for formation flying.
- Self-contained landing system.

All of the essential avionics, including communications, we estimate will weigh almost 300 pounds and represent about 25 percent of the total fly-away cost. Naturally, we hope for breakthroughs which will reduce both the costs and the weight. As I mentioned at the outset, these limited capabilities we categorize as essential do not meet our requirements of operation in the same visibility environment as the ground soldier.

Accordingly, we will include complete provisions for a navigational package that will fully meet operational requirements for the proposed time frame of the UTTAS, and hope that the state of the art improves to the point where newly developed equipment will be relatively inexpensive and reliable.

As a final subject for your consideration, I would like to mention night vision devices. If we are to provide sustained day-night support to combat operations, we must be able to perform during the hours of darkness as well as during daylight. Considerable effort and money have been expended by both the military services and industry toward night vision devices.

Image intensification, low light level television, radar and forward looking infrared systems have been developed, tested, and deployed to Southeast Asia. We are pleased with the progress made thus far, and we intend to continue to explore the various uses and capabilities of our current night vision systems. We have made significant breakthroughs in night vision performance, and our main concern with the technology is in reducing the weight, size, complexity, and cost, and in developing new applications, such as navigation, positioning, and approach capabilities. An optimum night vision system might well provide the capability for terrain avoidance, station keeping, and remote area landing system for all Army aircraft. The ability to see at night and in adverse weather will make night operations routine and result in reduced vulnerability of our helicopter fleet to visually sighted weapons.

I have provided you with "user" information—information from which you can direct your efforts and resources in the research and development area of navigation. We of the Army Combat Developments Command and the entire Army aviation family are confident that together we can produce the vision to victory.

Flare Test Range Opened

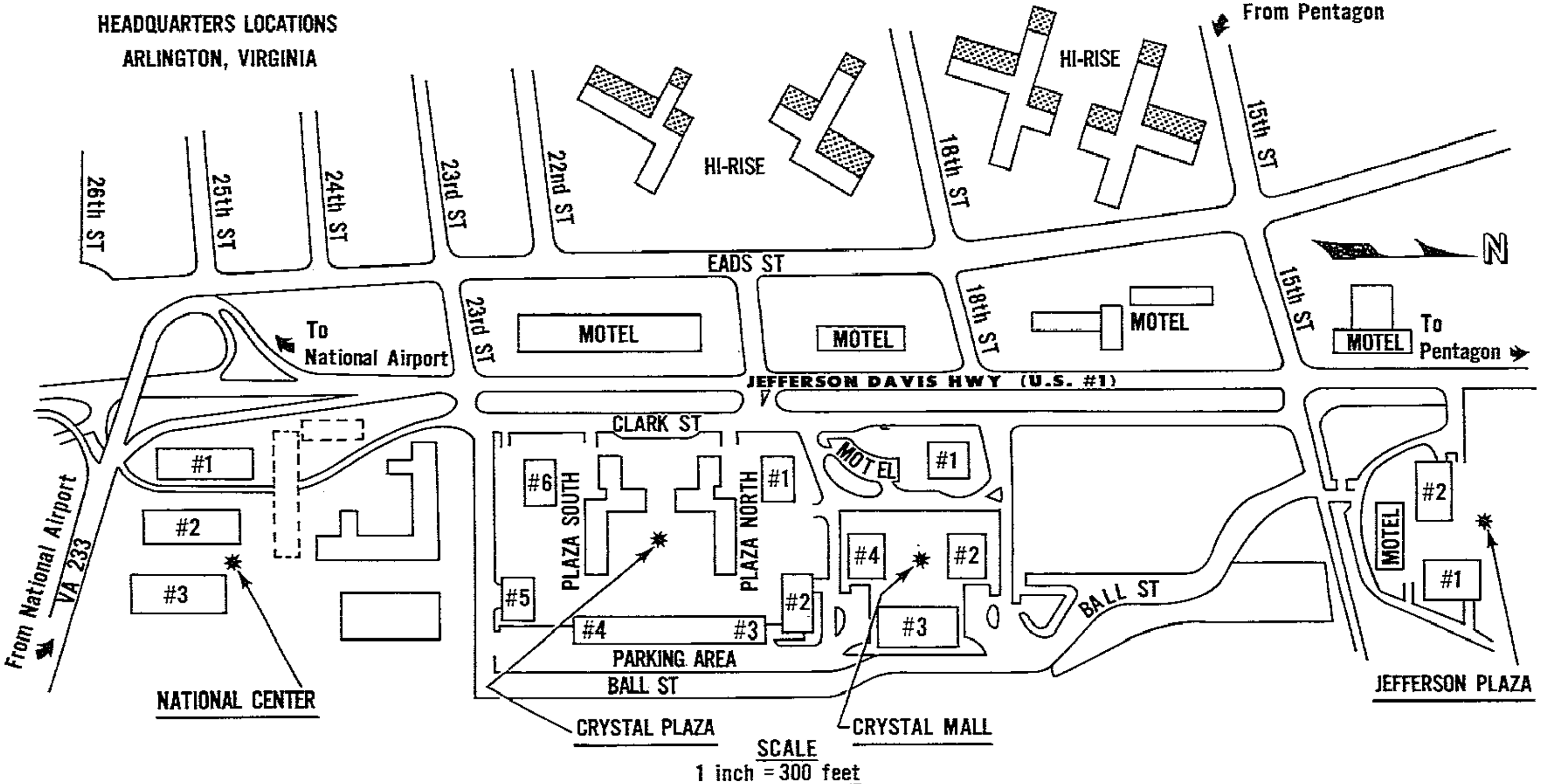
A Pyrotechnic Evaluation Range has been established at the Army's Yuma Proving Ground, Yuma, Arizona. The range measures and records effective ground illumination during deployment of pyrotechnic flares, eliminating the need for theoretical computations, an integral part of previous tests.

The range contains 361 photocell sensor positions located in a rectangular pattern in a field measuring 1.5 by 1.5 miles. The sensors can respond to light levels above 0.05 to 0.20 foot-candles, the current DOD design criteria. A display panel in the central control building shows the pattern of sensors triggered by the flare being tested. The pattern is photographed and correlated with test data from cinetheodolite tracking cameras. The cameras complete the engineering description of flare performance as to position in space and light pattern on the ground.

Navy Offices Moved

Naval Material Command and subordinate systems commands headquarters have completed their moves from Main Navy and Munitions buildings to Arlington, Va. The map on the following page locates the headquarters in relation to the Pentagon and National Airport.

NAVAL MATERIAL COMMAND
HEADQUARTERS LOCATIONS
ARLINGTON, VIRGINIA



* National Center	* Crystal Plaza	* Crystal Mall	* Jefferson Plaza
#1 ELECTRONIC SYSTEMS COMMAND #2 ORDNANCE SYSTEMS COMMAND #3 SHIPS SYSTEMS COMMAND	#5 NAVAL MATERIAL COMMAND #6 ADMINISTRATIVE OFFICE	#3 SUPPLY SYSTEMS COMMAND	#1 & 2 AIR SYSTEMS COMMAND

9/70

Army Will Test Industry Developed STANO Items

Lieutenant Colonel Victor H. Bray, USA

Project MASSTER (Mobile Army Sensor System, Test Evaluation and Review) is designed to provide the Army a capability to sift and sort the myriad of material items, systems and concepts proposed for surveillance, target acquisition and night observation (STANO). Basically Project MASSTER responds to Army needs in two ways. It responds to the Army Materiel Command by testing material. It responds to the Army Combat Developments Command by testing doctrine and concepts for employing the material.

Activities to date have been concentrated on Army developed or sponsored materiel and ideas. But this is not the limit of Project MASSTER's interest. Recognizing the great potential of U.S. industry and its significant contribution to Army requirements in the past, special procedures were established to expedite review of industry test requests, decisions to test, review of test results, and decisions concerning future use of STANO-related material and concepts.

This article explains these procedures. It addresses the general concept of how the Army processes an unsolicited request for test of STANO-related material, who can approve or disapprove, how the requester can learn the status of his request, and what the requester can do to expedite the process.

A request for test from a non-government source should be sent to the Army Materiel Command (AMC), where the unsolicited proposals office assigns a control number and determines if a Memorandum of Understanding between the Government and the requester exists. This document is required by Army Regulation 27-60, paragraph 304b.*

A Memorandum of Understanding states:

> "It is understood that the Department of the Army has accepted the above proposal for the purpose of evaluating it and advising of any possible Army interest, provided that the acceptance to determine such interest does not imply or create a promise to pay; an obligation to give up any legal right or to assume any duty; a recognition of novelty, originality or priority; or any express or implied contractual obligation or other relationship such as would render the Government liable to pay for or to give up any legal right or assume any obligation for any disclosure, evaluation or use of any information in the proposal to which the Government would otherwise lawfully be entitled."

If a Memorandum of Understanding between the requester and the Government is required and not already existing, the request is put aside until the memorandum has been obtained from the requester. When the Memorandum of Understanding is in hand, AMC initiates a technical evaluation of the proposal. At the same time, AMC forwards a copy of the request to the Combat Developments Command (CDC). The AMC technical evaluation considers:

Completeness of the Request. It should contain, as a minimum, detailed technical description of the ma-

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**Army Regulations cited in this article may be obtained from the Commanding Officer, U.S. Army Publication Agency, Attention: AGDD-I, Washington, D.C. 20315.*

teriel, its capabilities and military potential, restrictions under which technical data and any proprietary rights represented in the materiel will be released to the Army, a summary of any previous government tests/evaluations, and a proposed test plan.

Military Potential. STANO-related materiel proposed to be tested must have potential military utility. The request should include performance characteristics and configuration for its probable use environment. (The materiel need not satisfy an existing Qualitative Materiel Requirement (QMR) or Small Development Requirement (SDR), but should be oriented toward the satisfaction of a military materiel requirement or objective.)

Development Status. STANO-related materiel proposed for test must have been developed and fabricated to a point whereby testing at the proposed time would accomplish a useful result for the Army.

Facility Requirements. Facility requirements for test and evaluation must be compatible with the test capabilities of Project MASSTER.

Simultaneously with the AMC technical evaluation, CDC will review the request package. The CDC review determines if the materiel proposed for test meets a military requirement. If it does, and no approved requirements document exists, CDC must develop an appropriate document or determine if the materiel proposed for test should undergo functional and organizational experimentation and/or field exercise tests at Project MASSTER.

General Categories of STANO Items

Night Vision Devices
Surveillance Aircraft
Personnel Detectors
Equipment Detectors
Radars
Ground Sensors
Photographic Equipment
Optical Equipment
Aural Equipment
Electronic Surveillance Equipment
Information Transmission, Identification and Positioning Devices & Systems
Test, Measurement & Diagnostic Equipment

Test Conditions

If directed to test, Project MASSTER will contact the requester to obtain an agreement for testing conditions. The agreement document is called a Test and Bailment Agreement. It specifies security requirements and stipulates specific rights and liabilities concerning administration, logistics, operation, test data usage, equipment damage, personnel injury, schedules and costs. As a condition for Army agreement to test, the Test and Bailment Agreement stipulates that the requester agrees to:

- Deliver the required test materiel, in the proper quantities at a prescribed time, to the designated test site. (Costs associated with delivery and testing of the materiel will have to be negotiated on a case-by-case basis; however, normally delivery costs will be borne by the non-government source.)
- Perform receiving inspection of the materiel at the test site and make certain that it is in operating condition.
- Provide written operating procedures and operator training, if required.
- Provide necessary and timely maintenance, maintenance documentation, and maintenance support, to include all parts and labor, for materiel furnished.
- Remove the test materiel from the test site at the completion of the test operation or upon demand by the Government.
- A disclaimer of government liability for loss or damage to persons or property.

Within 25 days of test completion, AMC will convene a review board consisting of representatives from AMC (the developer), CDC (representing the user), Continental Army Command (the trainer), and the Logistics Doctrine, Systems, and Readiness Agency (representing the logistician). This board meets in an in-process review in accordance with provisions of Army Regulation 705-5.

It is the responsibility of the review board to evaluate test results, Project MASSTER recommendations, and tl requirements against which the mat riel was tested. Following the evalu tion, a recommendation is made t Headquarters, Department of th Army, concerning the future of tl tested materiel. The board will eith recommend where in the Army's mat riel life cycle (prescribed in Arm Regulation 11-25) the materiel shou be placed, or recommend that no fu ther consideration be given to the pr posal. The range of recommendatio to continue consideration of the pr posed materiel go from entry into a vanced or engineering development acceptance as standard Army materi (Army Regulation 71-6).

Headquarters, Department of tl Army, will consider the review board recommendations and make the fi determination.

Positive Control

The procedures described here we designed to provide for a normal fl toward acceptance of the request f test and testing. More effort is r quired to deny the request than allow it to go through the proce except when the requester fails to p vide sufficient information.

Positive controls have been est lished to ensure that requests a processed speedily and not lost in t "administrative mill." Immediat upon receipt of a request, a sequent

control number is assigned. This number remains as the identifying number of the request until it is dropped from Army accountability. A decision to drop from accountability must be fully documented. A quarterly report showing the status of all requests is provided to the STANO Systems Manager with information copies to other Department of the Army staff elements, members of the review board, and Project Director, Project MASSTER.

Army procedures require communication with the non-government requester. Following receipt of the request at Headquarters, AMC, the requester will be notified that his request has been received and that it will be evaluated or, as previously mentioned, that further processing of his request will be held in suspense until a Memorandum of Understanding has been signed and delivered to AMC.

Following completion of the AMC and CDC reviews, AMC will provide the requester with the results of the technical evaluation and combat developments review and advise him either that the evaluation is terminated or that testing will be conducted at Project MASSTER. In the latter case, the requester will be informed that test guidance is being provided to Project MASSTER through the STANO Systems Manager at Headquarters, Department of the Army, and that the Project Director, Project MASSTER, will contact him for execution of the Testing and Bailment Agreement. When Headquarters, Department of the Army, has provided AMC with a decision on the future of the tested materiel, AMC must notify all concerned, including the requester, of the decision.

The preceding discussion has concerned AMC and CDC handling of test requests from non-government sources. Similar procedures are in effect for the Army Security Agency (ASA). The basic difference is that ASA is responsible for both development and user representation. Therefore, the exchange of information between these two function elements is internal to ASA.

These procedures may seem rather drawn out and time consuming. However, each step has been a candidate for elimination and has survived a critical examination made considering interests of both the Government and the non-government requester. The surviving steps provide positive controls to prevent inadvertent rejection of a request, to ensure economy of resources to prevent expending effort where there is no military requirement or to cover ground previously covered, and to allow testing to be worked into the Project MASSTER schedule.

What Requester Must Do

There are several steps which can be taken by the test requester to expedite consideration of his request and testing of his materiel. First, of course, he must submit a complete package, as described earlier. Second, he can ensure that the request gets to the proper place.

Test requests for non-ASA items should be forwarded to:

Commanding General
U.S. Army Materiel Command
Attn: AMCRD-PS-P
Room 2739, Building T-7
Washington, D.C. 20315
Phone: (202) 697-5883
or 697-6075

Test requests for ASA items should be forwarded to:

Commanding General
U.S. Army Security Agency
Attn: IARD-T
Room 2020, Building A
Arlington Hall Station,
Va. 22212
Phone: (202) 692-5165

Third, the requester can include the required Memorandum of Understanding with his proposal. Fourth, he can provide a minimum of five copies of the entire package to AMC (two of these will stay in AMC, two will go to CDC, and one will go to Project MASSTER).

As insurance that the request does not go astray prior to assignment of a control number, an information copy of the letter of transmittal could be provided to Headquarters, Department of the Army, Office of the Chief of Research and Development, Attention: CRDSTN, Washington, D.C. 20310.

You, industry, now know how to get the results of your efforts into this process. Your move!

Industrial Defense, Disaster Planning Courses Offered

The schedule of classes for the Industrial Defense and Disaster Planning for Privately Owned and Operated Facilities Course, FY 1971, has been confirmed. The five-day, tuition-free course will be given to industry and government executives at the Army Military Police School, Fort Gordon, Ga.

Reporting dates are Dec. 13, 1970; Feb. 28, 1971; March 21, 1971; and May 16, 1971.

The course will provide a working knowledge of planning measures to safeguard industrial facilities from hostile or destructive acts.

Subjects will include the industrial defense program, natural disasters, nuclear weapons, mutual aid, disaster control operations, emergency communications, industrial physical security planning, corporate survival, and disaster plan test. Also covered will be legal aspects of civil disturbance, and planning for civil disturbances.

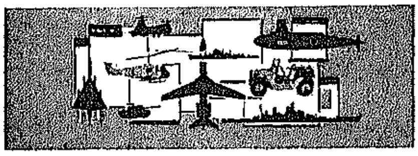
Priority will be given to executives of private facilities participating in the DOD Industrial Defense Program, and to government personnel whose duties include national emergency, mobilization, or disaster planning. No security clearance will be required.

Accommodations have been arranged at a local motel. Daily transportation will be provided.

Executives whose facilities participate in the DOD Industrial Defense Program should send their applications to the Army Headquarters that conducts surveys of the programs at their facilities. Other industrial representatives and Federal, state and local government officials should apply to: The Provost Marshal General, Department of the Army, ATTN: PMGS-D, Washington D.C. 20314.

Guided Bomb Program Moved to ADTC

Guided bomb programs, directed by the Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio, have been transferred to the Armament Development and Test Center (ADTC), Eglin AFB, Fla. Both ASD and ADTC are elements of the Air Force Systems Command.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of August 1970.

DEFENSE SUPPLY AGENCY

17—The Defense Personnel Support Center, Philadelphia, Pa., is issuing the following contracts for men's field cold-weather coats:
*Alpha Industries, Inc., Knoxville, Tenn. $1,027,143. 200,978 coats. DSA 100-71-C-0180.
*John Ownbey Co., Inc., Knoxville, Tenn. $1,230,273. 238,426 coats. DSA 100-71-C-0181.

18—J. P. Stevens and Co., Inc., N.Y., N.Y. $1,067,472. 672,000 white cotton bed sheets. Seneca and Clemson, Oconee County, S.C. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0182.

28—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for fuel oil and gasoline for delivery in New York, New Jersey and Pennsylvania:
*Ace Fuel Oil Corp., Brooklyn, N.Y. $1,042,183. DSA 600-71-D-0320.
Agway, Inc., Syracuse, N.Y. $1,952,293. DSA 600-71-D-0321.
American Oil Co., Chicago, Ill. $1,318,-981. DSA 600-71-D-0315.
Texaco, Inc., Long Island City, N.Y. $1,021,513. DSA 600-71-D-0375.

31—Rebmar, Inc., Corezal, P.R. $2,027,710. 260,113 rucksacks. Bayamon, P.R., and Morovis Industries, Morovis, P.R. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0230.

DEPARTMENT OF THE ARMY

5—*E. E. Anderson and Co., Inc., Roswell, N.M. $1,828,530. Construction of an operational apron, arm-disarm pad and two taxiways, Luke AFB, Ariz. Army Engineer District, Los Angeles, Calif. DA-CA09-71-C-0010.

—Tampa Ship Repair and Dry Dock Co., Inc., Tampa, Fla. $1,445,254. Annual repairs to Corps of Engineers seagoing dredge. Army Engineer District, Jacksonville, Fla. DA-CW17-71-C-0017.

6—*Holloway and Son Construction Co., Inc., Middletown, Ky. $3,336,607. Relocation of approximately 8.9 miles of Kentucky highways 1274 and 1240, and Morgan County road 1009A, for the Cove Run Reservoir Project, Menifee and Rowan Counties, Ky. Army Engineer District, Louisville, Ky. DA-CW27-71-C-0016.

7—*James L. Ferry and Son, Sacramento, Calif. $1,130,695. Bank protection construction, Sacramento River Protection Project, Sacramento and Yolo Counties, Calif. Army Engineer District, Sacramento, Calif. DA-CW05-71-C-0021.

—*Paz Brothers, Inc., Bridgeport, N.J. $1,281,007. Construction of seven disposal areas on the Inland Waterway, Chesapeake and Delaware Canal, Del. Army Engineer District, Philadelphia, Pa. DA-CW61-71-C-0026.

10—Eugene Luhr and Co. and Potasknick Dredging, Inc., (joint venture), Columbia, Ill. $11,207,300. Excavation of approximately seven miles of navigation channel, Kaskaskia River Navigation Project, St. Clair County, Ill. Army Engineer District, St. Louis, Mo. DA-CW33-71-C-0021.

—Gregg, Gibson and Gregg, Inc., Leesburg, Fla. $1,975,676. Construction of an earth dike and a two-way reinforced concrete spillway with manually controlled, hydraulically operated vertical lift gates, Inglis Reservoir. DA-CW17-71-C-0020. $9,283,331, Construction of railroad and highway bridges; relocation of trackage and roads to provide clearance for the canal. DA-CW17-71-C-0019. $1,445,261. Construction of 14.2 miles of bank protection along the canal, Citrus and Levy counties. DA-CW17-71-C-0021. All above contracts are in connection with the Cross Florida Barge Canal Project. Army Engineer District, Jacksonville, Fla.

11—Xerox Corp., Pasadena, Calif. $1,000,000. Classified services. Army Electronics Command, Fort Monmouth, N.J.

—*R. W. Mier Construction Co., Denver, Colo. $1,278,850. Construction of a three-story administration building, Peterson Field, Colorado Springs, Colo. Army Engineer District, Omaha, Neb. DA-CA45-71-C-0023.

12—Honeywell, Inc., Hopkins, Minn. $2,026,-048 (contract modification). Production of metal parts for PDM551 fuzes. Twin Cities Army Ammunition Plant, New Brighton, Minn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-70-C-0104.

13—*Edward J. Troise, Sr., and EJT Construction Co., Inc. (joint venture), Glenside, Pa. $3,007,000. Construction of a supply warehouse and administration office, and a flyaway kit warehouse, Dover AFB, Del. Army Engineer District, Baltimore, Md. DA-CA31-71-C-0011.

14—Lockheed Electronics Co., Plainfield, N.J. $8,119,606. Scientific engineering, technical and support services for the continued operation, maintenance and future development of the electromagnetic environmental test facility, Fort Huachuca, Ariz. and vicinity, for three years beginning Sept. 1, 1970. Fort Huachuca, Ariz. DA-EA18-71-C-0012.

17—*A. G. Proctor Co., Inc., Aurora, Colo. $1,331,440. Construction of recreational facilities, Beltzville Reservoir, Lehighton, Pa. Army Engineer District, Philadelphia, Pa. DA-CW61-71-C-0027.

—*Arnold M. Diamond, Inc., Great Neck, N.Y. $1,224,214. Construction of a steel bulkhead, Point Pleasant Canal, N.J. Army Engineer District, Philadelphia, Pa. DA-CW61-71-C-0024.

—*D. R. Allen and Son, Inc., Fayetteville, N.C. $1,050,086. Expansion for 100 rail cars for the north rail holding yard, Sunny Point Army Terminal, N.C. Army Engineer District, Savannah, Ga. DA-CA21-71-C-0010.

—The Army Engineer District, Los Angeles, Calif., issued the following contracts:
*Cardan Co., Inc., Los Angeles, Calif. $1,638,400. Construction of 3 180-man dormitories, George AFB, Victorville, Calif. DA-CA09-71-C-0018.
*William J. Zapp, Colton, Calif. $1,146,-020. Construction of concrete apron pavement, Norton AFB, Calif. DA-CA09-71-C-0017.

18—Hughes Tool Co., Culver City, Calif. $1,-260,000. Tear down and repair 42 crash-damaged OH-6A aircraft. El Segundo, Calif. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-A-0017.

19—S and S Constructors, Lancaster, Calif. $6,969,696. Construction of a composite building housing 1,638 men plus classroom, battalion headquarters and five support buildings, Ft. Huachuca, Ariz. Army Engineer District, Los Angeles, Calif. DA-CA09-71-C-0011.

—*Joseph N. Daugherty, Inc., Little Rock, Ark. $1,591,081. Construction of a composite medical facility, Blytheville AFB, Ark. Army Engineer District, Fort Worth, Tex. DA-CA63-71-C-0028.

20—*H. M. Carlton Construction Corp., Houston, Texas. $4,463,960. Construction of approximately 2,772 linear feet of flood wall and closure structures for the Hurricane Flood Protection Project, Texas City, Galveston County, Texas. Army Engineer District, Galveston, Texas. DA-CW64-71-C-0010.

—Raytheon Co., Bedford, Mass. $2,865,313 (contract modification). Development of the SAM-D weapon. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1995.

24—The Army Engineer District, New Orleans, La., is awarding the two following contracts for levee enlargement, land and floodway side berms, East Atchafalaya Basin Protection Levee, Iverville Parish, La:
Houston-New Orleans, Inc., Belle Chasse, La. $1,376,429. DA-CW29-71-C-0022.
Great Lakes Dredge and Dock Co., New Orleans, La. $2,057,342. DA-CW29-71-C-0023.

25—Hughes Aircraft Co., Culver City, Calif. $1,514,555. Advance development of a solid state ballistic computer for the M60A1 tank. Army Weapons Command, Rock Island Arsenal, Rock Island, Ill. DA-AA25-71-C-0078.

—Owens-Illinois, Inc., Pittsburgh, Pa. $1,-011,500. Four cinetheodolites and support equipment to record moving target positions. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-71-C-0018.

—Thiokol Chemical Corp., Woodbine, Georgia. $8,090,400. Loading, assembling and packing of 81mm, illuminating, M301-A3 cartridges. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-71-C-0009.

26—*Kandy, Inc., Texarkana, Texas. $5,338,-744. Construction work, Carter's Dam, Coosawattee River, Murray County, Ga. Army Engineer District, Mobile, Ala. DA-CW01-71-C-0014.

—*N. R. Hamm Contractor, Inc., Perry, Kan. $1,775,290. Road relocation and public use development, Melvern Reservoir, Osage River, Osage County, Kan. Army Engineer District, Kansas City, Kan. DA-CW51-71-C-0018.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—*Small Business Firm—Company—Value—Material or Work to be Performed—Location of Work Performed (if other than company plant)—Contracting Agency—Contract Number.

—LTV Corp., Warren, Mich. $2,623,000. Retrofitting Lance missile ground support equipment. Army Missile Command, Redstone Arsenal, Huntsville, Ala. DA-20-113-AMC-01052(Z).

27—FMC Corp., San Jose, Calif. $30,288,194. M113 vehicles. Army Tank Automotive Command, Warren, Mich. DA-AE07-69-C-2600.

28—Federal Cartridge Corp., Minneapolis, Minn. $32,213,651 (contract modification). Operation of 5.56mm, M193 and 7.62mm small arms production facility, Twin Cities Army Ammunition Plant, Minneapolis, Minn. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-36-038-AMC-01090(A).

—*Ronal Industries, Inc., Port Chester, N.Y. $2,348,988. Winterizing M561/M792 1¼ ton trucks. Army Tank Automotive Command, Warren, Mich. DA-AE07-71-C-0030.

—General Motor Corp., Anderson, Ind. $1,411,330. 61,982 12 volt storage batteries. Anaheim, Calif. Army Tank Automotive Command, Warren, Mich. DA-AE07-71-C-1380.

—General Research Corp., Santa Barbara, Calif. $1,833,500. Data processing system analysis for the Advance Ballistic Missile Defense Agency. Army Safeguard System Command, Huntsville, Ala. DA-HC60-71-C-0015.

—Marathon Battery Co., St. Paul, Minn. $2,967,300. 630,000 dry batteries and associated test equipment. Procurement Div., Army Electronics Command, Philadelphia, Pa. DA-AB05-71-C-4324.

31—General Dynamics Corp., Rochester, N.Y. $1,769,478. 480 teletypewriter radios. Orlando, Fla. Army Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0035.

—The Army Missile Command, Huntsville, Ala., issued the following contracts:

Raytheon Co., Andover, Mass. $20,978,776. FY 1970/1971 Improved Hawk ground support equipment. DA-AH01-71-C-0796. $26,242,505. Improved Hawk missile for FY 1970 and 1971. Andover and Red River Army Depot, Texarkana, Tex. DA-AH01-71-C-0795.

Western Electric Co., New York, N.Y. $1,048,630 (contract modification). Research and development for the Safeguard Acquisition Perimeter Radar. Syracuse, N.Y. $7,667,720 (contract modification). Site and installation engineering material and checkout of the Tactical Softwear Control Site. Bell Telephone Labs, Whippany, N.J. DA-30-069-AMC-00333(Y).

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts for MTSQ M564 fuze metal parts:

McGraw Edison Co., Bristol, Conn. $6,338,170. DA-AA09-71-C-0014.

General Time Corp., La Salle, Ill. $3,296,609. Peru, Ill. DA-AA09-71-C-0015.

—The following contracts were awarded by the Army Engineer District, Mobile, Ala.:

General Electric Co., Pensacola, Fla. $3,581,335. Design, manufacture, test, installation and field testing of two 131,579 KVA/185,000 horsepower generator motors, Carter's Dam, Murray County, Ga. Schenectady, N.Y., and Ga. DA-CW01-71-C-0017.

*Allbritton-Williams, Inc., Tallahassee, Fla. $1,457,612. Construction of 3 three story dormitories, Eglin AFB, Fla. DA-CA01-71-C-0015.

DEPARTMENT OF THE NAVY

4—Hughes Aircraft Co., Culver City, Calif. $10,000,000 (contract modification). Incremental funding for the Phoenix missile. Culver City, El Segundo, Torrance and Fullerton, Calif., and Tucson, Ariz. Naval Air Systems Command, Washington, D.C. N00019-67-C-0240.

—Hughes Aircraft Co., Fullerton, Calif. $24,300,000. Engineering development of a target acquisition system for the Improved Point Defense Surface Missile System, and other shipboard self-defense weapons. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-4415.

6—Dyson and Co., Pensacola, Fla. $7,076,927. Construction of recruit barracks, Naval Training Center, Orlando, Fla. Naval Facilities Engineering Command, Washington, D.C. N62467-68-C-0349.

—Whittaker Corp., Saugus, Calif. $2,640,000. Mk 24 Mod 4 aircraft parachute flares. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-71-C-A001.

—Northrop Corp., Newbury Park, Calif. $2,959,210. Preproduction Mk 30 Mod O mobile antisubmarine warfare target vehicles. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1434.

—Pratt and Whitney Aircraft Div., United Aircraft Corp., East Hartford, Conn. $2,710,144. Spare parts for the F-14 aircraft's YTF-30-P412 engines. Naval Aviation Supply Office, Philadelphia, Pa. N00383-06-A-7015-0001.

7—North American Rockwell Corp., Anaheim, Calif. $4,132,900. Refurbishment and modification of nine Ship Inertial Navigation Systems. Navy Ship Systems Command, Washington, D.C. N00024-71-C-5022.

—Honeywell Inc., Minneapolis, Minn. $4,243,224 (contract modification). Rockeye II components. N00019-70-C-0140. $1,516,792 (contract modification). Special tooling and test equipment for the Rockeye II. N00019-70-C-0086. Naval Air Systems Command, Washington, D.C.

—Grumman Aerospace Corp., Bethpage, Long Island, N.Y. $11,300,000 (contract modification). Long lead time items to support FY 1971 procurement of A-6E aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0075.

10—Lockheed Aircraft Corp., Burbank, Calif. $20,000,000 (contract modification). Incremental funding for continued engineering development of the S-3A weapon system. Naval Air Systems Command, Washington, D.C. N00019-69-C-0385.

—Lockheed Missile and Space Co., Sunnyvale, Calif. $3,447,090. Engineering services to increase viability and effectiveness of existing Fleet Ballistic Missile re-entry system. N00030-71-C-0062. $1,700,000. Poseidon C-3 surface support equipment, missile test and readiness equipment, missile containers and liners. N00030-71-C-0068. Naval Strategic Systems Project Office, Washington, D.C.

11—Sperry Rand Corp., Syosset, N.Y. $2,080,000. Approximately 13,000 man-days of technical assistance for the Poseidon (C-3) Logistics Support Program. Naval Ship Systems Command, Washington, D.C. N00024-71-C-5060.

—Raytheon Co., Sudbury, Mass. $20,000,000. Poseidon guidance system electronics assemblies and associated components. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-C-0046.

—Lockheed Electronics Co., Plainfield, N.J. $7,200,000 (contract modification). Production of the Mk 86, a new computer-oriented gun fire control system. Naval Ordnance Systems Command, Washington, D.C. N00017-71-C-4204.

12—Treadwell Corp., N.Y., N.Y. $2,437,500. Overhaul of oxygen generators for nuclear submarines. Naval Shipyard, Portsmouth, N.H. N00102-71-C-0272.

—Texas Instruments, Inc., Dallas, Texas. $4,840,128 (contract modification). Incremental funding for the design, development and fabrication of AN/APS-116 radar sets for S-3A aircraft. Naval Air Systems Command, Washington, D.C. N00019-70-C-0308.

13—Hughes Aircraft Co., Fullerton, Calif. $8,567,700. Weapon Control Console Mk 81, Mod 0 and Signal Data Converter Mk 73, Mod 0 for fire control systems. Naval Ordnance Systems Command, Washington, D.C. N00017-C-70-1424.

14—Sundstrand Corp., Belvidere, Ill. $1,355,703. Five-axis, numerically controlled machining centers with tool changes. Navy Purchasing Office, Washington, D.C. N00600-70-C-1227.

—General Electric Co., Phoenix, Ariz. $2,760,139. Automatic data processing equipment for GE's 600 series system for use at the Naval Avionics Facility, Indianapolis, Ind. Navy Automatic Data Processing Equipment Selection Office, Washington, D.C. N66032-71-L-0003.

—Kaman Aerospace Corp., Bloomfield, Conn. $3,756,773 (contract modification). Conversion of UH-2A/B helicopters to an HH-2D configuration. Naval Air Systems Command, Washington, D.C. N00019-70-C-0051.

—Naval Strategic Systems Project Office, Washington, D.C., issued the following:

Bendix Corp., Teterboro, N.J. $7,064,695. Manufacture and repair of Poseidon inertial components. N00030-71-C-0090.

Honeywell, Inc., St. Petersburg, Fla. $4,008,412. Manufacture and repair of Poseidon inertial components. N00030-71-C-0091.

Interstate Electronics Corp., Anaheim, Calif. $1,165,000. Logistics Services in support of fleet ballistic missile test instrumentation. N00030-71-C-0063. $1,293,000. Engineering services in support of Poseidon test and evaluation program. N00030-71-C-0064.

17—The Naval Air Systems Command, Washington, D.C., issued the following contract modifications:

Hughes Aircraft Co., Culver City, Calif. $2,500,000. Increase of limitation of authorization for F-14 armament system development and evaluation testing. N00019-70-C-0343.

LTV Aerospace Corp., Dallas, Tex. $12,769,400. Long lead time items for FY 1971 A-7E aircraft. N00019-68-C-0075. $41,552,137. Long lead time items in support of FY 1971 A-7D aircraft for the Air Force. N00019-67-C-0143.

General Electric Co., Shenectady, N.Y. $22,445,000. Naval nuclear propulsion research, development and related work. N00024-70-C-5027.

18—The Naval Ship Systems Command, Washington, D.C. issued the following contracts:

Sperry Rand Corp., St. Paul, Minn. $1,771,888. Programming for the development and integration of the submarine (SSN-688) combat central computer system. N00024-71-C-1000.

Vitro Corp. of America, Silver Spring, Md. $1,352,805. Planning and engineering studies, analyses, reviews and evaluations for the SSN and SSBN submarine programs. N00024-71-C-0213.

Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $3,746,720 (contract modification). Long lead-time materials and equipment for nuclear-powered guided missile frigate, DLGN-38. N00024-70-C-0252 P00001.

19—Grumman Aerospace Corp., Bethpage, N.Y. $183,600,000 (contract modification). Installment funding for F-14A aircraft for the Navy. Naval Air Systems Command, Washington, D.C. N00019-69-C-0422.

—Lasko Metal Products, Inc., West Chester, Pa. $7,836,094. Bomb fins, Mk 15 Mod 3. Ship Parts Control Center, Mechanicsburg, Pa. N00104-71-C-A012.

—The Naval Facilities Engineering Command, Washington, D.C., awarded the following contracts:

Higgerson-Buchanan, Inc., Chesapeake, Va. $1,529,488. Construction of Aerial Gunnery Range Improvements at the Marine Corps Air Station, Cherry Point, N.C. N62470-69-C-0867.

R. D. Lambert and Son, Inc., Chesapeake, Va. $1,368,031. Construction of a cleaning and corrosion treatment building, Navel Air Rework Facility, Norfolk, Va. N62470-70-C-0800.

20—Simplex Wire and Cable Co., Portsmouth, N.H. $2,720,900. Manufacture of oceanographic cable. Naval Electronics Command, Washington, D.C. N00039-71-C-0301.

21—Hughes Aircraft Co., Los Angeles, Calif. $8,598,168 (contract modification). 15C8A

and 15C9 missile control trainers for F-14A aircraft weapon system. Naval Training Device Center, Orlando, Fla. N61339-70-C-0265.

—Granite Construction Co., Watsonville, Calif. $4,780,000. Construction of a taxiway apron access, apron loading, water mains and roads, Travis AFB, Fairfield, Calif. Naval Facilities Engineering Command, Washington, D.C. N62474-70-C-0141.

—Hughes Aircraft Co., Culver City, Calif. $1,769,449. Services and materials for work on the Forward Looking Infra-Red sub-system for the Night Observation Gunship (YOV-10D). Naval Regional Procurement Office, Los Angeles, Calif. N000123-70-C-1848.

24—Northrop Corp., Norwood, Mass. $1,141,227. Repair of 127 GL-V7 gyroscopes. Naval Ship Systems Command, Washington, D.C. N00024-71-C-5027.

—Christenson-Raber-Kief and Associates, Inc., Seattle, Wash. $2,466,400. Construction of a barracks and mess hall, Naval Station, Adak, Alaska. Naval Facilities Engineering Command, Washington, D.C. N62476-70-C-0095.

—General Electric Co., West Lynn, Mass. $18,400,000 (contract modification). Engineering development of the TF-34 turbofan engine for the S-3A aircraft. Naval Air Systems Command, Washington, D.C. N00019-68-C-0443.

25—The Naval Strategic Systems Project Office, Washington, D.C., issued the following contracts:

General Electric Co., Washington, D.C. $6,048,945. Research and development of fire control systems for the Poseidon fleet ballistic missile program. Pittsfield, Mass. N00030-C-0166.

Honeywell Inc., St. Petersburg, Fla. $1,227,564. Repair of Polaris inertial components. N00030-71-C-0013.

—Grumman Aerospace Corp., Bethpage, N.Y. $21,000,000 (contract modification). Long lead time items for the EA-6B aircraft. Naval Air Systems Command, Washington, D.C. N00019-67-C-0078.

26—The Naval Automatic Data Processing Equipment Selection Office, Washington, D.C. is issuing the following contract actions for replacement of peripheral components to IBM computer systems:

Potter Instrument Co., Inc., Plainview, N.Y. $5,311,635. N66032-71-C-0002.

California Computer Products, Inc., Anaheim, Calif. $4,443,595. N66032-71-C-0003.

Memorex Corp., Santa Clara, Calif. $1,669,480. N66032-71-C-0001.

Ampex Corp., Culver City, Calif. $1,334,088. N66032-71-C-0004.

—Raytheon Co., Portsmouth, R.I. $1,957,774. Two AN/BQS-12 sonar systems. Naval Ship Systems Command, Washington, D.C. N00024-70-C-1325.

27—Lockheed Aircraft Corp., Burbank, Calif. $20,000,000 (contract modification). Installment funding for the S-3A aircraft. N00019-69-C-0385. $1,348,306. Reliability testing of various P-3C aircraft avionics equipment. N00019-70-C-0610. Naval Air Systems Command, Washington, D.C.

31—Hughes Aircraft Co., Los Angeles, Calif. $2,270,000. Design data and long lead time items for one missile control officer trainer for F-14A weapons systems device 1509. Naval Training Device Center, Orlando, Fla. N61339-70-C-0255.

—Gary Aircraft Corp., San Antonio, Tex. $1,166,025 (contract modification). Complete overhaul of R-3350-32WA engines, including all components and accessories. Naval Air Systems Command, Washington, D.C. N00019-70-C-0434.

DEPARTMENT OF THE AIR FORCE

3—Chromalloy American Corp., San Antonio, Tex. $1,256,811. Repair services for vane and shroud assemblies of the J-57 engine, Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F41608-70-D-0212.

—McDonnell Douglas Corp., Long Beach, Calif. $35,820,694. Nine C-9A aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-68-C-0081.

4—General Electric Co., Bethesda, Md. $1,022,883. Rental of electronic data processing equipment for FY 1971. Offut AFB, Neb. Base Procurement Div., Offut AFB, Neb. F25600-71-M-0640.

—Rand Corp., Santa Monica, Calif. $6,000,000. Aerospace power studies and research. Office of Scientific Research, AFSC, Arlington, Va. F44620-67-C-0045.

—Westinghouse Electric Corp., Baltimore, Md. $1,600,000. Flexible turret system for the B-57G aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33615-71-C-1009.

5—General Electric Co., Arkansas City, Ark. $1,214,093. Overhaul and modification of aircraft engines. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F34601-69-D-3250.

—IBM Corp., Washington, D.C. $2,256,072. Rental of automatic data processing equipment for FY 1971. Offut AFB, Neb, Base Procurement Div., Offut AFB, Neb, F25600-71-M-0059.

6—TRW, Inc., Redondo Beach, Calif. $16,153,090. Non-development support for the
weapon system program.
3, Calif. F04701-70-C-0166.
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weapon system program.
165. Space and Missile Sys-
on, AFSC, Los Angeles,

rp., Marietta, Calif.
craft spare parts.
ntonio Air Materiel
Ga. AF33(657)-

Louis, Mo.

$1,300,650. Modification kits for F-4C, F-4D, F-4E, and RF-4-C aircraft. Robertson, Mo. Ogden Air Material Area, AFLC, Hill AFB, Utah. F4601-69-A-2245.

10—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

The Boeing Co., Seattle, Wash. $4,858,683. Design, development, study and test programs for Minuteman missiles. F04701-69-C-0153.

Aerojet General Corp., Sacramento, Calif. $2,740,393. Titan III B/C/D Stage I and II liquid rocket engine systems. F04701-70-C-0095.

—ITT Electro Physics Labs Inc., Hyattsville, Md. $1,316,000. Fabrication of a transportable high frequency transmitter facility. Rome Air Development Center, AFSC, Griffiss AFB, N.Y. F30602-71-C-0014.

—Bendix Corp., Teterboro, N.J. $1,441,744. Automatic test system used in conjunction with the testing of F-4 aircraft systems. Ogden Air Material Area, AFLC, Hill AFB, Utah. F42650-71-C-0010.

11—Hayes International Corp., Birmingham, Ala. $6,025,114. Inspection, repair and modification of KC-135 aircraft for FY 1971. Oklahoma City Air Material Area, AFLC, Tinker AFB, Okla. F34601-68-C-3007.

—Lockheed Aircraft Corp., Marietta, Ga. $1,070,613. Aerospace ground equipment for C-5A aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-15053.

—Hughes Aircraft Co., Canoga Park, Calif. $3,143,000. Components for the Falcon missile. Tucson, Ariz. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1014.

13—Lockheed Aircraft Corp., Marietta, Ga. $1,209,326. C-5A aircraft spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF (657)-15053.

14—Lockheed Aircraft Corp., Marietta, Ga. $50,000,000. Allotment of funds, C-5A contract. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF 33(657)-15053.

—*Wolverine Diesel Power Co., Detroit, Mich. $1,366,477. Diesel generator sets, type A/M32A-60A. Traverse City, Mich. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. F04606-70-D-0039.

—The following contracts were issued by the Electronics Systems Division, AFSC, L. G. Hanscom Field, Mass.:

RCA, Moorestown, N.J. $1,925,000. Radar equipment. F19628-67-C-0209.

*Sierra Research Corp., Buffalo, N.Y. $1,250,000 (contract modification). Supplies and services for a hurricane research program. F19628-70-C-0293.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., has awarded the following contracts:

Tracor Inc., Austin, Texas. $8,154,027. Mk 1A penetration aids applicable to the Minuteman II weapon system. F04701-70-C-0159.

The Boeing Co., Seattle, Wash. $19,550,000. Force modernization of the Minuteman weapon system. F04701-63-C-0042.

19—International Harvester Co., San Diego, Calif. $1,052,707. A/E 24-U-8 turbine driven generators. Sacramento Air Material Area, AFLC, McClellan AFB, Calif. F04606-68-D-0648.

—General Dynamics Corp., Fort Worth, Tex. $1,572,036. Supplemental agreement to a contract for F-111A aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33 (657)-13403.

—Collins Radio Co., Dallas, Tex. $1,030,613. Electronics communications equipment, C-8500. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-68-C-0095.

20—Philco-Ford Corp., Newport Beach, Calif. $3,380,407. Target designator equipment for F-4D aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0345.

—Honeywell Inc., Minneapolis, Minn. $1,054,984. Supplies and services for the modification of F-101 series aircraft. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F34001-69-A-2584.

21—General Electric Co., Cincinnati, Ohio. $27,600,000. Spare parts applicable to the J-79 turbojet aircraft engine. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-71-D-0026.

25—Lockheed Aircraft Corp., Marietta, Ga. $2,504,793. Spare parts for the C-5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657)15053.

—General Dynamics Corp., Fort Worth, Tex. $191,297,000. Completion of funding for billing price adjustment on the F-111 program. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)13403, Change Order No. 423.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., is issuing the following contracts:

Thiokol Chemical Corp., Briston, Pa. $3,315,000. Stage I motors for Minuteman III. F0471-69-C-0197.

Lockheed Aircraft Corp., Sunnyvale, Calif. $12,060,148. Operation and maintenance of the Vandenberg tracking station and the satellite test annex. F04701-70-C-0013.

Philco-Ford Corp., Palo Alto, Calif. $12,358,388. Operation and maintenance of Air Force satellite control facility tracking stations. New Boston, N.H., and overseas. F04701-70-C-0014.

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Lockheed Aircraft Corp., Sunnyvale, Calif. $6,391,033. Operation and maintenance of Air Force satellite control facility tracking stations at Kaena Point, Hawaii and Chiniak Point, Alaska. F04701-70-C-0012.

Philco-Ford Corp., Palo Alto, Calif. $4,855,121. Logistic support management of the Air Force satellite control facility. F04701-70-0006.

26—The Oklahoma Air Material Area, AFLC, Tinker AFB, Oklahoma, issued the following contracts:

Collins Radio Co., Dallas, Tex. $1,380,000. To engineer, furnish and install a voice/data multiplex system, Vandenberg AFB. F34601-70-C-3349.

The Boeing Co., Wichita, Kan. $1,652,400. Development of a prototype modification kit for D, G, and H models of B-52 aircraft. F34601-70-C-2772.

27—Lockheed Aircraft Corp., Marietta, Ga. $1,658,218. C-5A aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-15058.

—Sanders Associates, Inc., Bedford, Mass. $1,508,304. Airborne ordnance fuzes. Armament Development and Test Center, AFSC, Eglin AFB, Fla. F33657-68-C-0658.

—Martin Marietta Corp., Denver, Colo. $30,822,112. Design, development, fabrication and delivery of Titan III-D space booster and associated aerospace ground equipment. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04695-67-C-0041.

28—The Ogden Air Materiel Area, AFLC, Hill AFB, Utah, issued the following contracts for Minuteman III weapon system equipment:

The Boeing Co., Seattle, Wash. $1,646,244. Trainer test set equipment. F04606-70-A-70084.

Radiation, Inc., Melbourne, Fla. $1,027,032. Electronic programmer assemblies. F09603-A-1444.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

Radiation, Inc., Melbourne, Fla. $1,028,755. Electronic equipment. Palm Bay, Fla. F04701-70-C-0251.

Avco-Everett Research Laboratory, Everett, Mass. $1,342,049. Scientific direction of the Advanced Research Projects Agency Mt. Haleakala Optical Station program. Wailuku, Maui, Hawaii. F04701-69-C-0212.

—General Dynamics Corp., Fort Worth, Tex. $1,255,680. F-111 aircraft spare parts. Sacramento Air Materiel Area, AFLC, McClellan AFB, Calif. AF33(657)-13408.

31—Hughes Aircraft Co., Culver City, Calif. $1,250,566. An advanced interceptor armament system. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33615-70-C-1364.

Centrifuge Tests Inertial Guidance Systems

Addition of a large centrifuge now allows precise, controlled testing of inertial guidance systems at the Air Force Systems Command's Missile Development Center, Holloman AFB, N.M.

An unusually exact, precisely known acceleration is called for in the development, test, and evaluation of inertial guidance systems. The large centrifuge meets this need. It can provide prolonged periods of high gravity acceleration and can exactly repeat all acceleration levels. These are essential features that rocket sled and laboratory bench tests cannot offer.

A unique feature of this system is a counter rotating platform, upon which inertial navigation systems are mounted for testing. Fixed at one end of the large arm of the centrifuge, the platform turns at the same speed as the arm, but in the opposite direction. Thus, the platform, while under high g forces, remains oriented in a fixed direction or bearing (azimuth). Undesirable effects of angular velocity which result from normal centrifuge testing are eliminated, and drift information can be obtained from guidance systems.

The distance from the center of the large arm of the centrifuge to the center of the counter rotating platform is 260 inches, making it the largest centrifuge in the Air Force. The centrifuge was designed to achieve a maximum acceleration of 100 gs.

New System Speeds Inertial Guidance Tests

Design studies for a system for accurate inflight evaluation of inertial navigation systems are being sponsored by the Central Inertial Guidance Test Facility at Holloman AFB, N.M. The Completely Integrated Reference Instrumentation System (CIRIS) will basically eliminate the need for ground-based radars and computers in testing inertial guidance systems.

CIRIS consists of an inertial navigation platform, a radio ranging device, a digital computer, a digital tape recorder, and a real time reference. The radio ranging device, the most important component, consists of an interrogator on the plane and a small transponder on the ground. Elapsed time between the transmission of a signal from the interrogator to the transponder and back again determines the location of the aircraft in relation to the transponder. The location of the transponder is precisely known, and the performance of the system being tested can be determined by comparing data from the system and CIRIS.

The transponder is portable, allowing tests to be conducted anywhere in the United States.

Evaluation of inertial guidance systems can now be accomplished in minimal time, without the need to wait for post-flight reduction of radar data.

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Space Chamber Adapted for Rocket Plume Studies

An improved cryopumping capacity and advanced instrumentation have given a space chamber at Arnold Engineering Development Center (AEDC) the capacity for research into plume technology.

The 42-by-82 foot vacuum chamber contains more than 113,000 cubic feet of space. With the changes, altitude conditions of more than 300,000 feet can be maintained for appreciable periods during rocket motor firing.

The main modification has been to increase the chamber's cryopumping capacity with an open-ended cylinder 18 feet in diameter and 18 feet tall. Liquid hydrogen flows through the outer wall of the cylinder and both gaseous and liquid helium circulate through the core. The cylinder is suspended vertically from the roof of the chamber with its open end facing the exhaust nozzle of the test rocket motor mounted near the floor. The expanded cryopumping capacity also improves altitude conditions that can be maintained during non-combustion testing.

Another major change is the installation of a circular support structure covering nearly the full diameter of the chamber. Instrumentation is attached to cross members to map plume fields as ' is raised and lowered above the rocket

abrication, and installation of the adoment in the chamber, part of the Aerospace Environmental Facility at AEDC, was done by personnel of ARO, Inc., contract operator of the testing center. The hardware can be readily removed when the chamber is to be used for normal environmental testing.

Plume technology involves the study of rocket motor exhaust effects. Among the exhaust effects being studied are contamination, heating, effects on flight vehicle stability, and electrical interference created by high temperature plume gases. For example, at high speeds in space, exhaust gases from large rocket motors can creep up the sides of the missile itself, creating undesirable forces on aft control surfaces and subjecting the base of the missile to heating effects. Also, the size and shape of a trailing plume can affect flight characteristics of missiles or rockets, while hot gases can interfere with guidance and control signals from the ground.

For several years, all four major testing divisions at AEDC have conducted tests related to some aspect of plume technology. Among major programs that have benefited from these tests have been Saturn, Minuteman, Nike-Zeus, and Manned Orbiting Laboratory.

With the modification of the space chamber, AEDC engineers have a valuable tool for still broader and more detailed studies.

AEDC is part of Air Force Systems Command, Arnold AFS, Tenn.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1970 431-510/3

DEFENSE INDUSTRY BULLETIN

NOVEMBER 1970

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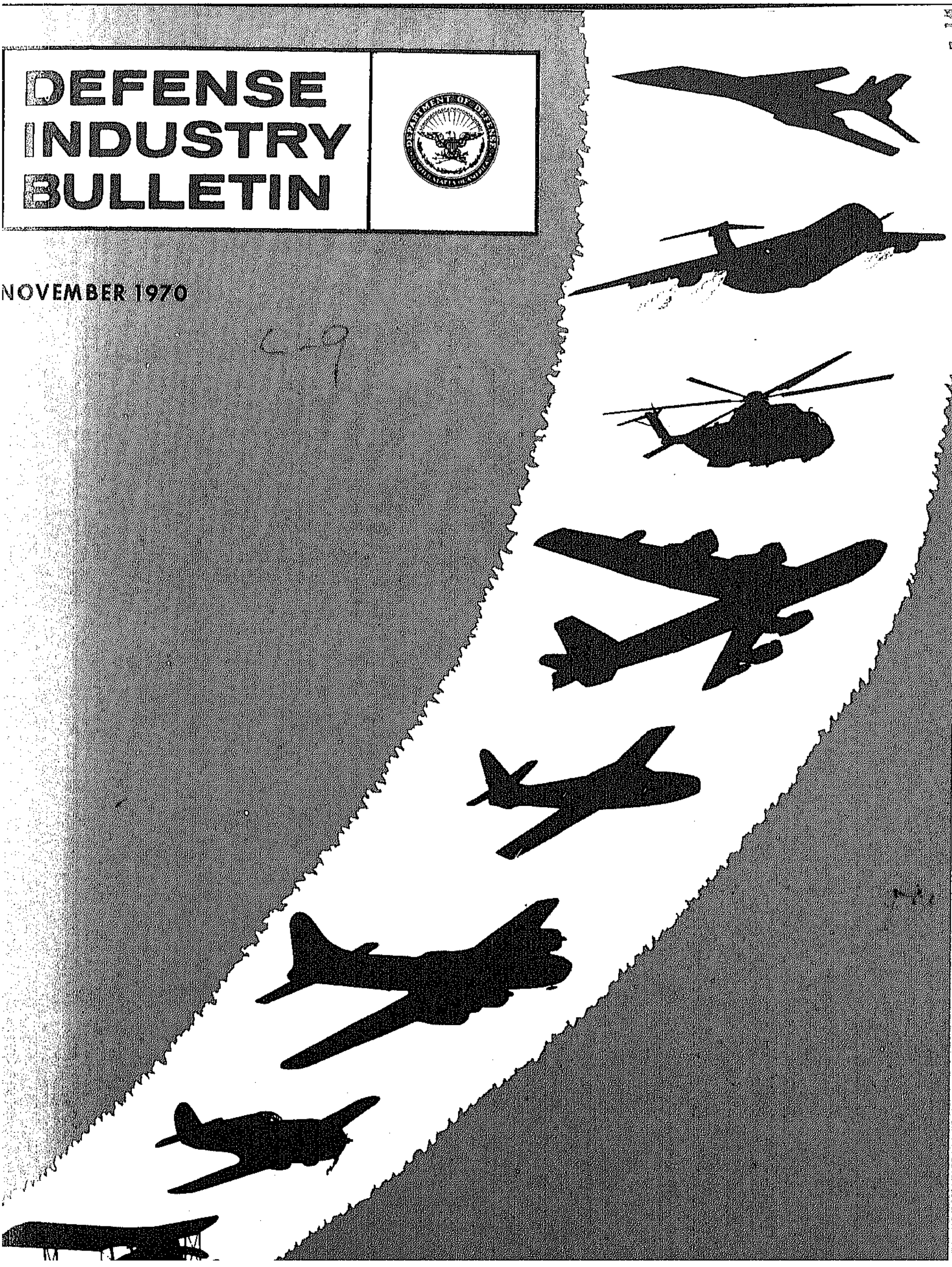

DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 11 November 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds approved by the Director, Bureau of the Budget, Nov. 2, 1965.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

IN THIS ISSUE

FEATURES

DEPARTMENTS

About the Cover The coming decade will be one of transition for the U.S. Air Force to support the Nixon Doctrine. Symbolizing the continuing transition of the Air Force, aircraft of the past stretch toward the future. From the bottom: S.E. 5A; 75A-1; B-17E; F-84F; B-52H; HH-3E Jolly Green Giant; C-5; B-1 advanced strategic bomber, still on the drawing boards. Air Force leaders discuss the next decade on pages 1, 3, and 6.

The Air Force in the 1970s

Excerpts from the address by Hon. Robert C. Seamans Jr., Secretary of the Air Force, at the Air Force Association annual convention, Washington, D.C., Sept. 23, 1970.

The Nixon Administration, as you know, is in the process of re-examining both domestic and national security policy. The on-going comprehensive investigations by the National Security Council will continue and they will attempt to be as precise as is possible in redetermining our national goals and re-evaluating our national priorities.

One trend is certainly visible: the reduction of our forces abroad and austerity in our Defense budget. Taking inflation into account, the 1968 Defense budget of $78 billion today would cost approximately $85 billion. Our FY 1971 DOD budget is down to $71.8 billion and this includes approximately $4 billion for badly needed pay raises. Thus, in three years we have had a reduction of more than $17 billion in terms of current dollars for defense programs other than personnel. Moreover, our FY 1971 budget is at its lowest level since before the Korean War, both as a percent of the Gross National Product and as a percent of the total Federal budget.

We face a number of difficult choices as we move into this era of reduced defense spending. We in the Air Force are very much aware of the vital domestic needs which place increasing demands upon the national budget, and we recognize that reducing defense expenditures frees resources to meet domestic needs and helps to curb inflation.

I might note here that defense spending alone is not responsible for the current inflation. For instance, the 1960 Federal budget of $92 billion has risen to almost $201 billion—a $109 billion increase. Yet defense spending accounted for less than $30 billion of this increase. It follows, therefore, that there are limits to how much a reduction in the Defense budget can do to correct our overall national budget. Nevertheless, careful scrutiny of defense spending must continue, and reductions made whenever feasible. I am sure that you understand the compelling reasons for these past and present cutbacks, and how they, in turn, impact upon defense industry.

The shift of human and materiel resources that may no longer be needed for national security presents difficult problems. For example, in the last year the Defense Department reduced its civilian and military manpower by 471,000. Defense-related industry has reduced its employment rolls by nearly 400,000, with approximately 600,000 more expected by this time next year. Within the aerospace industry itself employment dropped by about 200,000 from May 1969 to May 1970, and a loss of 1 percent per month, or 120,000, is now projected through December. While there are indications that this rate of decline may flatten out after the first of the year, the fact remains that considerable technological and scientific and manufacturing expertise may have been permanently lost to the aerospace community.

We are now in a transitional phase, and the reduction in certain defense outlays which we hope to achieve is dependent, in considerable degree, upon firm understanding between the United States and the Soviet Union. We certainly want to give maximum opportunity for the on-going Strategic Arms Limitation Talks (SALT) to be successful and to move nearer to the era of negotiation, which President Nixon and the American people seek, rather than confrontation. Current U.S. peace initiatives in the Middle East support this objective. We will continue to search for a solution to this volatile situation. The President is also lessening our involvement in Vietnam. In the last 12 months, we have reduced our forces in Southeast Asia from 500,000 to under 400,000 men and women.

Dr. Robert C. Seamans Jr.

* * * * *

In our efforts to achieve an effective agreement in SALT, we do not intend any premature or exaggerated reduction in U.S. military strength which could undermine our long-term security. In the absence of an arms control agreement which would protect and enhance American security—we must take those actions which will ensure that we will still be able to deter a strategic attack during the next 5 to 10 years.

As each of you is aware, Soviet strategic forces are growing not diminishing, and it is the Administration's policy to provide the American public with the maximum degree of disclosure possible concerning the nature and scope of the threat. . . . [See *The Threat*, page 19, this issue.]

Modern Forces Needed

For the Air Force to continue to maintain a credible deterrent, we must modernize our strategic offensive and defensive forces. Two developments increase my concern in this regard: first, the increased numbers and total payload of Soviet ICBMs, and second, the Soviet deployment of an initial ABM system and continued extensive ABM research. The combined effect could be a considerable reduction in the effectiveness of both our land- and sea-based missiles. We are deploying antiballistic missile protection for our missile fields and strengthening the penetration capability of our missiles with the deployment of multiple independent re-entry vehicles. There would be an inherent risk if deterrence were dependent on missiles alone.

To use a very rough analogy, two legs of a three-legged stool do not give us the same stability, even if greatly strengthened and enlarged. A dispersed manned bomber force, having quick reaction, is that third leg. It might be possible to undermine the effectiveness of either missiles or bombers alone, but to counter both at the same time would be a vastly more difficult problem. We must retain this stabilizing capability for the indefinite future. The B–1 gives us an improved system to do the job and represents the most economically feasible means to achieve this end. It is simply cheaper to replace the B–52 than to modify it and update it indefinitely. Given the decade of lead time involved, we must expedite the development of this aircraft. The decision to go into production will hinge on both development results and our strategic situation at that time.

* * * * *

As we look toward our tactical requirements for the 1970s and 1980s, we see that the family of Soviet fighters is becoming superior to our own. In the area of air superiority, skill and determination can go only so far in compensating for an aging system. The air-to-air combat problem is the primary concern in our development of the F–15, which will have superior capability for close-in, highly maneuverable combat. In short, it will provide the effective weapon system necessary to defeat an enemy fighter.

In another area of tactical concern, we are convinced that effective close air support will continue to be a vital mission for the Air Force and that an aircraft specifically tailored for that role is required. As a result, we are proceeding with the development of the A–X.

To modernize our airlift capability, we are relying heavily on the C–5, which will produce a revolution in air mobility. For instance, in 1973, with the C–5 in the inventory, projections indicate that we will be able to move an Army division with equipment and six fighter squadrons with support units to Europe in less than one week.

Now these key Air Force requirements, to which I have referred, are important. Nevertheless, each will be examined in light of the dollar constraints which I mentioned earlier, and will be weighed, among other considerations, against our personnel needs. These will be very difficult choices, and they will involve some tightening of our belts in both personnel and equipment areas.

What we are striving for, and I'm sure that you and a majority of Americans support this objective, is the maintenance of defense forces which are strong enough to keep the peace but, at the same time, do not unnecessarily absorb resources we need for progress in other areas. Although the active Air Force may be smaller in such a situation, I am convinced that our deterrent capability during the next decade can and will be effective. I foresee an Air Force that is leaner, more mobile, more streamlined, better equipped, trained and motivated and more volunteer oriented.

I want to emphasize that these qualifications must apply to our Guard and Reserve forces as well. Their contribution to America's deterrent strength has always been significant; yet, with reduced active duty strength, there will be an increased reliance on both their combat and combat support units. One month ago Secretary Laird directed that, and I quote, "a total force concept will be applied in all aspects of planning, programming, manning, equipping and employing Guard and Reserve Forces." Further, the Secretaries of the Military Departments were asked to provide the necessary resources in FY 1972 and future budgets to permit the development of the balanced forces desired. Implementation of Secretary Laird's guidance is now underway within the Department of the Air Force.

Industry Is Vital

Our Air Force, employing this total force concept, will, of course, continue to need the productive capacity of private industry, and its contribution toward advancing our technology is fundamental. In no other area of defense is this capability more vital than in the aerospace industry. Successful deterrence is fundamentally dependent upon our avoiding any significant technological gap in aerospace. This is a critical objective and we are dependent upon all members of the research and development community to help attain it, whether they are in industry, universities, or government.

In closing, let me say this. To meet the growing threat, the United States is reevaluating our long-range goals and attempting to bring our force structures and our short-range goals into harmony with them. This process does not involve laying down our world leadership, nor sacrificing the interests of our allies or friends. This process will take time, however, for the country to understand and adopt. It must involve frank public discussion, and I urge you in the Air Force Association to continue your signal efforts in stimulating constructive public involvement in the subject of our nation's security.

I hardly need convince this audience of the need for America to achieve progress through peace and security. It is a task as urgent today as in the time of our founding fathers. We must continue to redefine that task to satisfy the needs of our own age.

Aerospace Forces for Deterrence

Excerpts from the address by Gen. John D. Ryan, Chief of Staff, U.S. Air Force, at the Air Force Association annual convention, Washington, D.C., Sept. 22, 1970.

* * * * *

The expressions of policy that give direction to our efforts are contained in President Nixon's Feb. 19, 1970, Report to Congress on Foreign Relations. Most significant to the Air Force are those portions of the report dealing with the threat and with the purpose and design of this country's strategic and tactical forces.

These portions remind us first of all that "Recent Soviet programs have emphasized both quantitative and qualitative improvements in the capabilities of their forces."

. . . President Nixon, after addressing these aspects of the threat, set forth two specific questions:

First, "Should a President, in the event of a nuclear attack, be left with the single option of ordering the mass destruction of enemy civilians, in the face of the certainty that it would be followed by the mass slaughter of Americans?"

Second, "Should the concept of assured destruction be narrowly defined and should it be the only measure of our ability to deter the variety of threats we face?"

President Nixon also emphasized that the overriding purpose of our strategic posture is ". . . to deny other countries the ability to impose their will on the United States and its allies under the weight of strategic military superiority." He added that "We must insure that all potential aggressors see unacceptable risks in contemplating a nuclear attack or nuclear blackmail. . . ."

All of our preparations for the performance of this strategic role are aimed at these necessities. And additional guidelines that recognize these necessities have reached us in elaborated form through the National Security Council and the Defense Department.

In light of this guidance, there are key strategic tasks which the Air Force—as part of the defense team—must be prepared to accomplish for the remainder of this decade. Against the most critical possibility, that of a full scale attack on this country, we must be prepared to do two things. We must have the capability of destroying the remaining strategic weapons which the enemy no doubt would hold in reserve. We must also have the second-strike capability of destroying a sufficiently large proportion of his industry and population so that he would have no incentive for a full scale attack in the first place.

We're convinced that this dual capability will provide our best means of deterring or denying success to an attempted disarming first strike.

We're also convinced that the strategic force should continue to include what we call the *Triad*, consisting of manned bombers and land-based and sea-based missiles. This combination of retaliatory weapons complicates the enemy's problem of targeting and of timing his attacks. To a like degree, the *Triad* also complicates his problem of defense against a coordinated counterattack.

Now let's see how some of the new developments in national policy have affected the role of the Air Force at the tactical level of military operations. Again, the best indicators available on this subject are contained in the President's Report on Foreign Relations. This document tells us first of all that "while strategic forces must deter all threats of general war, no matter what the cost, our general purpose forces must be more sensitively related to local situations. . . ." And it also tells us that while our country has 95 percent of the nuclear power of the non-Communist world, the planning for general purpose, or tactical, forces "must take into account the fact that the manpower of our friends greatly exceeds our own. . . ."

Gen. John D. Ryan, USAF

Combined with other statements on the Nixon Doctrine and the Asian policy, this guidance calls for a reduction of our military presence in overseas areas and for our allies to assume the primary responsibility for providing the manpower for their own defense. It further indicates, in my judgment, a corresponding need for greater reliance on U. S. airpower as a means of using our superior tech-

nology to full advantage.

In line with this guidance, we are placing greater emphasis on training and equipping the air forces of our allies. By far the most impressive example of returns on that effort is now offered by our part of the Vietnamization program in Southeast Asia. As a result of our advice and assistance, the fighter squadrons of the Vietnamese Air Force have consistently achieved operational standards comparable to our own.

Where the direct use of U. S. military forces is essential in protecting our interests, the Air Force is being called upon for more and better support in the fields of attack fighter operations and airlift.

In the tactical missions of interdiction and close air support, we've been able to capitalize on two advantages. One is the improved performance and mobility of our fighters. And the other is the greater effectiveness of our conventional ordnance against a variety of military targets. In our tactical operations, we've also devised much better equipment and techniques for accurate weapon delivery at night and in all types of weather.

Airlift in recent months has become a factor of growing importance. One reason for this is that we are facing sizable reductions in our forces that are permanently deployed in certain overseas areas. We therefore must depend more and more on airlift—both strategic and tactical—as a means of rapid deployment and resupply of those forces.

Aerospace Assets

In the process of using aerospace as a major arena for deterrent operations, we draw heavily on several assets. The most important asset is the superior skill and dedication of our people. Another asset is the basic validity of our operating concepts. And still another is the ability of our aerospace industry and technology to give us a qualitative edge in our weapons.

Measuring these assets against future demands, I can assure you that our people—the pilots, aircrew members and technicians—are getting better all the time. At every stage of experience, they know more, they attempt more, and they accomplish more than any generation I have seen.

As to concepts, I'll mention just one view of deterrence that runs through our thinking in the Air Force. Although many people see the effort to deter as an "either/or" proposition, we believe it's a dynamic process. Moreover, it's a process that remains both operative and effective at least in some degree at all levels of conflict below that of full scale war. In a conflict that is underway, for example, the enemy who foregoes escalation by reason of the greater risk involved has actually been deterred in a practical and important sense of the term. And that holds true even if he continues to fight on a reduced scale. We, therefore, want to confront him at all levels with a risk in relation to gain that is clearly prohibitive. At the strategic level, we have done that by combining a credible posture with a show of force when required. At the tactical level, these two measures have not in all cases been adequate to convey the message of unacceptable risk. So, the ability to use force on occasion as an instrument of operative deterrence remains essential to the protection of our national interests.

Demanding Task Ahead

So much for concepts. The most demanding task we face now in conjunction with science and industry is that of translating available resources into appropriate and effective weapons. One difficulty here is that maintaining an operational force is demanding a significant portion of the resources that otherwise could be applied against our future requirements. Thus tradeoffs, by necessity, are being made between the hardware needed for today and the more advanced development leading to such items as vertical takeoff aircraft and additional space systems.

I'm glad to report, however, that some of the systems we are trying to bring into the force over the next five years will incorporate important advances in technology. As one example, the use of weight-saving composite materials made from boron and graphite could open the door to major gains in aircraft performance. Depending on our needs, we might concentrate on the resultant opportunities for improvement in maneuverability and range. On the other hand, we might take our gains in terms of a greater volume and variety of conventional ordnance or the improved effectiveness of fire control and countermeasures equipment. In another development program, we are making progress toward guided weapons that can destroy targets under almost any condition of darkness or weather.

Future Systems

These are some of the ways in which we can achieve the modernization required to meet the threat. The funding for these and many other approved steps toward modernization is by no means assured. But their urgency is underscored by the fact that over half of our aircraft inventory is more than nine years old. I'm therefore going to discuss some of the more important new systems we expect for the future.

In the most critical area of strategic offense, we are scoring a measure of qualitative improvement in the ICBM force through the introduction of the Minuteman III. This missile, with a multiple independently targetable reentry vehicle, will be our best means of destroying time-urgent targets like the long-range weapons of the enemy.

To help modernize our strategic bomber force, it now appears that we will also get four squadrons of FB–111s. Equally important for this purpose, we have the B–1 advanced bomber approved for engineering development toward a first flight by the mid-1970s. We hope to have the B-1 operational by the end of this decade. This aircraft will provide our national leadership with many additional choices at all levels of conflict.

We must also combine these new strategic weapons with the more advanced communications, warning and reconnaissance systems that are needed for the effective management of our forces. One important step in that direction will be to obtain an Advanced Airborne Command Post as a replacement for the KC–135 that has been adapted for that purpose.

Satellite surveillance is another key element of our total arrangement for the command and control of forces. From the standpoint of aerospace operations, one of our primary interests

in this type of surveillance will be to obtain early warning of ballistic missile attack.

To achieve some degree of modernization in our air defense system, we are planning an Airborne Warning and Control System and Over-the-Horizon radars. We have an urgent need for the AWACS to replace the elements of the ground-based radar and control system that are now being phased down. This system could also be used to advantage for the command and control of our deployed tactical forces.

In our tactical forces, we are making some progress toward modernization with the F-111 and A-7 attack fighters that are now in production. Both of these aircraft will have a close-air support and interdiction role. We have high confidence that when we have completed the structural test program on the F-111 it should be the best all-weather attack aircraft in the world.

The A-X, as our primary close-air support system, will be the first plane that we have produced specifically for that role. Backed up by the A-7 and the F-4, it will be able to fly lower and slower attack patterns and deliver heavy and varied payloads with greater accuracy.

To ensure control of the air against the tougher competition that we see ahead of us in the 1970s, we are developing the F-15 air superiority fighter. This fighter promises to exceed the performance of any competitive design we can foresee in the next 10 years. It should be operational by the mid-1970s.

In the airlift picture, the C-5—even at a reduced buy—will help give us a better than threefold increase over the capability we had in this field just five years ago. To modernize our tactical airlift force, we are evaluating two systems. One is a vertical/short takeoff and landing, light intratheater transport called the VSTOL LIT. And the other is a high speed, long-range medium STOL transport known as the MST. Each of these approaches, however, calls for a larger development effort than we can support within our budget for the next two years. So we are now in the process of selecting a transport that is available for early procurement to provide an interim STOL capability. With adequate funding support, these systems undoubtedly will bring us to much higher levels of effectiveness.

In the strategic area, I believe our improvement will be measured chiefly in qualitative terms—greater selectivity of response, greater accuracy, and faster reaction. In tactical operations, our most important gains should be in close-air support and all-weather interdiction. In airlift, the greater capacity and efficiency of our large transports should continue to make these systems more competitive for all types of passenger and cargo movement.

Finally, we have to consider all of these gains in relation to a growing challenge presented by the thrust of Soviet technology. Only by meeting that challenge effectively can we ensure that aerospace continues to be an expanding matrix for deterrence—not a corridor of hostile aggression. That is a mission of hope and high purpose. It demands—as I said earlier—all of the ability and enthusiasm that we can muster.

WWMCCS Request for Proposal Issued

The Air Force has issued Requests for Proposals (RFPs) to 17 companies for the replacement and modernization of data processing equipment at the World Wide Military Command and Control System (WWMCSS) headquarters, and related Intelligence Data Handling Systems.

Proposals are due February 1, 1971, and evaluation of the proposals is to be completed within approximately 90 days after receipt. The contract is expected to be awarded in May-June 1971.

The Department of Defense will procure a minimum of 15 new standardized computing systems for WWMCCS with an option for 20 additional computers during FY 1972-73. It is planned that a minimum of nine systems will be ordered in FY 1972. Machine sizes will range from medium to large.

If proposals result in prices exceeding $46.2 million from all proposers for the hardware and software for the 15 systems, the Government may re-examine its requirements, restate such requirements, cancel or amend the solicitation and resolicit proposals for its requirements.

The procurement represents the first time the computing needs of command and control and intelligence users will be satisfied by machine systems acquired from a single source. Activities may tailor the standard configuration to meet individual requirements with the winning vendor's equipment.

The Air Force Systems Command's Electronic Systems Division at L. G. Hanscom Field, Massachusetts, is responsible for the selection of the automatic data processing equipment and associated software. The General Services Administration will negotiate the contract and the Joint Chiefs of Staff will be responsible for allocating equipment to users. The Defense Communications Agency is responsible for centralized software support.

Requests for Proposals were issued to:

Burroughs Corp., Defense, Space and Special Systems Group, Paoli, Pa.

Collins Radio Co., Richardson, Tex.

Control Data Corp., Rockville, Md.

Delta Data Systems Corp., Cornwall Heights, Pa.

Digital Equipment Corp., Waltham, Mass.

Electronic Associates, Inc., West Long Branch, N.J.

F&M Systems Co., Dallas, Tex.

General Electric Co., Federal Systems Operations, Bethesda, Md.

Honeywell, Inc., Federal Systems Division, Arlington, Va.

IBM Corp., Cambridge, Mass.

Kollsman Instrument Corp., Syosset, N.Y.

Philco-Ford Corp., Burlington, Mass.

RCA, Air Force/DOD Programs, Rosslyn, Va.

Sanders Associates, Inc., Data Systems Division, Nashua, N.H.

Xerox Data Systems, Rockville, Md.

Sylvania Electronic Systems, Eastern Division, Needham Heights, Mass.

Univac, Division of Sperry Rand, Corp., Washington, D.C.

Airlift for Strategic Mobility

Excerpts from a presentation given by Gen. Jack J. Catton, USAF, at the 25th Annual National Defense Transportation Association Forum, San Francisco, Calif., Sept. 23, 1970.

I think it is important, before proceeding, that we remind ourselves that the military does not *develop* national policy. The military *serves* national policy. We do our utmost to meet the national objectives developed and established by our civilian national leadership—leaders chosen by the citizens of the United States. Today these leaders find a nation in a period of substantial transition. Probably a greater transition than we have seen in our lifetime. Our society is demanding that our leadership take a very careful look at where the nation is headed, and in what priority we should distribute our national resources and our national efforts—more to domestic needs, less to defense.

* * * * *

In response to this policy, the emerging defense strategy is forming this pattern:

- Maintenance of strategic forces of unquestionable sufficiency.
- Limiting the use of American fighting forces in the offshore conflicts that, perhaps, can be handled better by the involved nations' manpower and American advice, weapons and financial support.
- Reduction of American garrisons overseas.
- Development of highly mobile, quick-reacting, hard-hitting, general purpose fighting forces available in the United States ready for use when and where required.

It is hoped such a military strategy will permit the nation—with acceptable risk—to spend less for national defense and more towards solution of domestic problems. . . .

* * * * *

The challenge to us, then, is substantial—we must enhance the quality, responsiveness and power of the military forces that are retained.

Evolving military strategy places great dependence upon mobility—the right kind of mobility—rapid, reliable, responsive, and sustaining—the kind of mobility that will permit the President to have options.

One such option is the low profile abroad, the remote presence concept of Senator Stuart Symington, where there would be a reduction of U.S. troop strength overseas. A reduction, but with the full realization on the part of our allies and our enemies that strategic mobility would be able to return them as integral units, complete with battle gear and initial supplies.

For the first time we are achieving the capability to move the guts of our ground fighting forces—the heavy fire power—their armor—heavy tracked vehicles—rapidly—anywhere in the world. Contrast this with the classic example of the mobility we *didn't* have in 1950 when the North Koreans hurled 10 divisions across the 38th parallel, expecting to overrun the south and achieve a quick victory. We didn't have forces in place to meet such an attack, nor did we have the mobility to deploy an adequate counter-force rapidly. As a matter of fact, we could only put two rifle companies on the line. So, we traded precious lives and territory for time. It took two weeks for one division to arrive from Japan. Nine days later, two more divisions arrived from Far East areas. The first division from the continental United States—*and here is the heart of the matter*—did not arrive until D + 56 days. There is good reason to believe the North Koreans were convinced they could prevail before any outside force could be brought in. Fortunately, they were wrong, but only by the *narrowest* of margins.

* * * * *

I'd like to point out that, while we are looking toward the future of mobility, this mobility we seek—that we need—is not only a function of airlift. We need mobility that is rapid, reliable and responsive—airlift. But we also require *sustaining lift*—90 percent of our logistics support must

General Jack J. Catton, USAF, became Commander, Military Airlift Command (MAC), Scott AFB, Ill., in August 1969. Previously he served as Commander, 15th Air Force, March AFB, Calif., and Deputy Chief of Staff, Programs and Resources, Hq., USAF, Washington, D.C.

come by sea. If we are to do our job properly for the Defense Department we must provide total strategic mobility and that includes sealift. I see no advantage—possibly even military disaster—in a situation where modern military and civilian aircraft team up to deliver a fighting force able to close with the enemy, only to find that an antiquated military and civilian sealift force can't sustain their effort....

With this background of the needs for strategic mobility in the emerging national policy and the military strategy that responds to it, I'll narrow the subject to airlift.

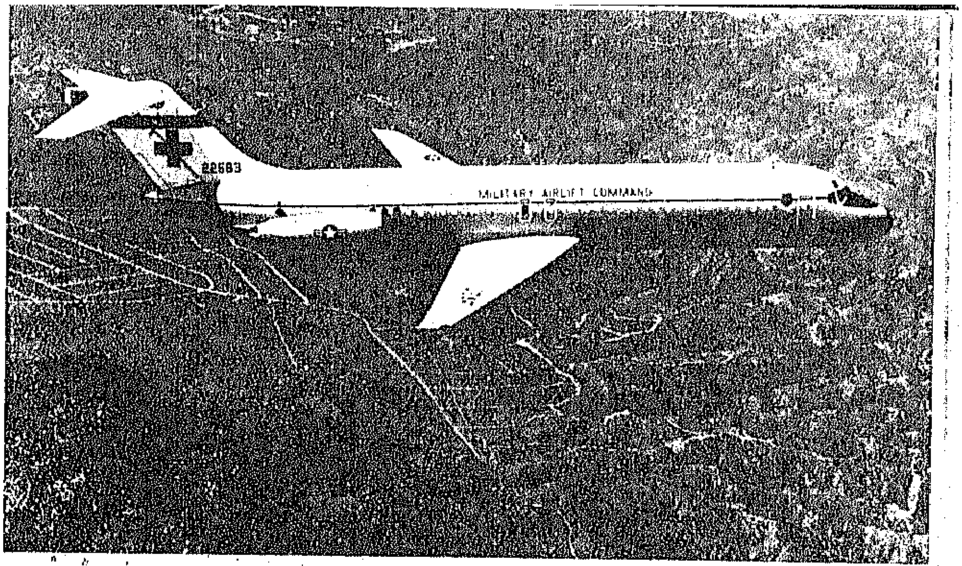
In the airlift portion, I can say we are gaining qualitatively. The C–5/C–141 team is contributing greatly to that kind of mobility we need. The brunt of the operation must fall to the active force which through its peacetime operations will have provided a base from which to surge.

Exercise for Contingency

We have to continually guard against atrophy—the disease in which a part of the body withers from lack of proper use. If we don't exercise our facilities, if we don't stretch our maintenance capability, if we don't work out our crews, just like a muscle, we'll lose the ability to flex, to respond.

We had that happen in the recent past when it took just about a year to get the C–141 fleet operating at a wartime level. And so this peacetime operation is a big one. Better than 150 modern jet aircraft are in the system each day. These aircraft operate daily at a better than six-hour utilization rate. They operate throughout the world with a reliability rate that charts consistently above 90 percent. And they do a cost effective job for DOD.

But running a logistics support service is our secondary responsibility. We must stay geared for the contingency. So when the time comes, the maintenance folks will be able to generate more flying time, the aircraft will easily hack the extra load, the flight crews will hustle even more, and our utilization rate will jump to over eight hours. And, if required, we can surge to better than 10 hours a day. We will meet the commitment at a time when to fail would have international implications.



C–9 Nightingale aeromedical evacuation aircraft.

Fortunately, we don't have to go it alone with our active force. Our thoroughly successful Reserve Associate Program is there to help. Day in and day out, reservists provide us with a ⅔-an-hour per day capability in our steady state operation while they train. These are the guys who fly with us every day. You know them and their story, but just let me bring you up to date.

Currently, we have 11 C–141 associate airlift squadrons and one C–9 associate air evacuation squadron.

The airlift squadrons are manned on a one-to-one crew-to-aircraft ratio, and our goal is an associate squadron for each active squadron.

The C–9 program has a most impressive record. This associate adds a full hour a day to the steady state utilization rate while helping to maintain a 99 percent reliability rate. Whether airlift or aeromedical, the materiel support squadron generates the additional flying hours, and the crews fly it off—all of this short of mobilization—thus using their training a productive airlift way.

In addition to the associate program, we have daily help from our National Guard units. They operate better than a dozen aircraft a day, getting around an 8-hours-per-day-per-aircraft utilization rate on the aircraft they operate despite the fact these birds are older, harder to maintain prop aircraft.

Even more important, both airlift facets of the Reserve program—the associate and the MAC-gained units—have substantial assets to contribute in time of contingency. In the case of the associate, we can count on an extra two or more hours on our active jet force aircraft every day, with the associate providing the whole package of maintenance, crew, and air terminal support. Our Guard C–124s are outsized airlift that still have life in them. They have difficulties. They are slow; they require support throughout the flow pattern on which they are used. I recognize that. At the same time, they do represent an outsized capability that could be very useful as MAC-gained units for some period of time.

A third source of lift available to us both in a contingency and normal situation is civilian augmentation. It's difficult to figure a utilization rate for our civilian augmentation in our day-to-day operations because we contract for a specific job. We get the aircraft without the regular utilization rate degraders, like maintenance inspections. But their contributions have been great and continue to be.

There has been a recent decline in tonnage since the Vietnam peak years of 1967–68 when we did $700 million in commercial augmentation. But that decline is expected to level off. The tonnage may start to climb again as cost effectiveness dictates the paths of the future. In the past decade, the ton-mile cost dropped nearly 50 percent, bringing tariffs into the neighborhood of 10 cents a ton-mile, as more things become economically air eligible and air compatible.

The overall budget squeeze should also contribute to an upward trend as our sister services find they can no

longer afford to keep large inventories spread thin throughout the world. The speed and reliability of our force has shortened the pipeline time to the point where it is more economical to perform depot maintenance here in the United States than to maintain costly overseas facilities.

The proposed Army closed loop system—a potentially substantial airlift requirement producer—is a sample of what we look for in the future in cargo operations.

The passenger outlook is a continuation of the recent past, where commercial air has been the principal means of moving DOD passengers—in fact, 91 percent of our passengers last year were moved by commercial augmentation—the future posture looks for more of the same.

This produces a paradox: a peacetime need for commercial passenger airlift, but a greatly expanded contingency requirement for cargo service. This is precisely the reason we have encouraged the carriers to equip themselves with convertibles. However, we understand each air carrier operates for public convenience and necessity, and we must encourage each carrier to continue to look to the civil sector for its primary source of revenue. Despite the fact we bought around $600 million dollars of commercial airlift last year, DOD expenditures are too unpredictable to form an economic base for carrier equipment decisions.

In the emergency situation, we have an arrangement by which we can take advantage of the largest, most modern and capable aviation industry in the world—at a 10-hour-per-day utilization rate. This is the CRAF program —Civil Reserve Air Fleet.

This CRAF fleet is made up of the same carriers who perform for us in our normal day-to-day operation. Or, more precisely, it is the other way around. The carriers who handle our normal requirements do so only because they are committed to CRAF. Thus a CRAF commitment is the required key that opens the door to permit a carrier to get in on the peacetime augmentation buy. And that key must turn on modern equipment, passenger and cargo, preferably both, as represented by the convertibles. So in a contingency, we can tap these carriers for airlift, committed to us by tail number.

We have never had to use this force in the past, but this 10-hour-per-day rate is a substantial capability when we need it. It equates to the movement of over 4,000 tons of bulk cargo and close to 18,000 passengers per day from the U.S. east coast to Europe. The cargo capability increases by 300 tons per day following introduction of convertible DC–10s in 1973.

CRAF helps us to meet our currently planned wartime passenger requirements, but the combination of Regular airlift forces, Reserve and CRAF does not meet bulk cargo requirements.

What's more, the CRAF cargo capability does not provide any outsize cargo airlift. Then two problems: the outsize, the bulk.

In the area of outsize, civil aircraft, including new generation wide-body jet convertibles, do not have the capability to transport outsize cargo or conduct roll-on, roll-off operations like the C–141 and C–5. Fortunately, an increasing number of C–5s with a prime mission of high density outsize cargo are becoming available to us. They represent our only real capability for this kind of operation in the future.

The bulk deficit on one hand could be erased by additional carrier buys of DC–10 or L–1011 convertibles or freighters. These aircraft do provide a great step forward in bulk cargo capability. On the other hand, the deficit could also increase as older 707s and DC–8 cargo-capable aircraft are retired. We intend to maintain a mix of wide-body stretch and standard jets to provide flexibility for small loads or for airfields without wide-body aircraft ground support equipment.

So the future demands of a *contingency* will be met by a smooth blending of the increased performance of our all-jet worldwide and highly professional military airlift aided by highly trained reservists and by commercial augmentation—a step up on our steady state operation. The future of that steady state operation looks busy.

It is a future with a great challenge to MAC. . . .

The national policy and the military strategy that supports it makes tremendous demands on mobility. . . .We must assure the resources and the determination to meet the challenge. Our nation is depending on us.

Prisoners of War Missing in Action

In connection with our efforts to achieve an honorable settlement in Vietnam, I want to mention one tragic issue that troubles all Americans. That is the refusal of North Vietnam to agree to humane treatment of prisoners of war or to provide information about men missing in action. Our present administration policy is to foster public discussion and focus worldwide attention on the plight of our prisoners of war in order to obtain proper treatment for them and gain their release. We in the Air Force greatly appreciate the efforts of the Air Force Association to get more Americans involved by expressing their concern over "just 1500" of their countrymen. . . . It is an important consideration in our nation's effort to achieve peace in Vietnam.

We have not done our job until we get those men home.

Robert C. Seamans,
Secretary of the Air Force
Sept. 23, 1970

Financial Management Aspects of Weapon System Acquisition Policy

Robert C. Moot

Excerpts from a statement by Hon. Robert C. Moot, Assistant Secretary of Defense (Comptroller), to the Subcommittee on Military Operations, House Committee on Government Operations, Sept. 23, 1970.

As a foundation for my subsequent remarks, it will be helpful to briefly review this revised [Weapon System Acquisition] Policy, particularly those provisions which relate to financial management. Under [Deputy Secretary of Defense David] Packard's concept, a major weapon system will pass through three principal phases: conceptual development, full scale development, and production. . . . Careful assessments are made at the DOD level to ensure that each of the first two phases has been adequately and legitimately completed before the subsequent phase is entered. This sequential evaluation concept offers financial management advantages and poses financial impacts which I will discuss later.

As an additional point of background, it is important to consider the magnitude of defense procurement. The intent here is not to minimize the problem but to place it in perspective relative to total government outlays. . . .

In order to gain this perspective, we should examine the investment level involved from two standpoints: magnitude and trend. To be truly meaningful, these data must be considered in constant dollars as well as in current dollars. In this way, real capability acquired as well as total financial outlays can be assessed. As shown (Figure 1), total defense outlays for procurement in constant dollars declined from 1954 to 1961 from just under $20 billion to $13.5 billion, increased to $17 billion in 1963, declined to $15.3 billion in 1964, then rose to a Vietnam peak of about $21 billion in 1968–69, and is forecast to decline to just over $15 billion in 1971.

As would be expected, non-war procurements amount to considerably less during 1966 to 1969. With the scheduled Vietnam phase-out, this line becomes representative of what we can expect in the future. It is interesting to note that at the end of FY 1970, the trend was approaching the 1964 pre-war level which was the lowest since 1954. This trend is of concern when viewed in the context of sorely needed force modernization.

Research development, test and evaluation funds held fairly constant at just under $3 billion through FY 1959, held between $6 billion and $7 billion in 1961 to 1968 and have fallen to slightly less than $6 billion for 1970–1971. Overall fluctuations in the past 10 years have not been especially significant. It is not expected that the new acquisition policy will materially influence this funding trend. Although, as mentioned earlier, certain developmental efforts may be terminated earlier, more intensified developmental and evaluation attention will be devoted to programs offering promise.

Two conclusions are drawn from these trends. With noticeably declining acquisition funds, the results of the new policy will not be as dramatic as may have occurred during times of more aggressive weapon system acquisition. There just is not as great a potential for vast improvement or cost avoidance when procurements, especially new procurements, are drastically curtailed. On the other hand, it is clear that defense must acquire the maximum security posture possible within the limits of available funds. It is our intention to do this, and the new policy is expected to be instrumental in this effort.

With this background then, I will devote the balance of my statement to a discussion of: the normal financial controls which affect procurement, the financial management impact of the new Weapons System Acquisition Policy, and plans for additional improvement.

Financial Control

Within the regular managerial practice of the Department, there are several functions which exert financial control upon procurement. These include the apportionment of appropriated funds, the preparation of the

Hon. Robert C. Moot

Five Year Defense Plan (FYDP), the Development Concept Paper, the regular budget review, Selected Acquisition Reports (SAR), Defense Contract Audit Agency efforts, and cost performance reporting.

The FYDP has increased in effectiveness as a financial control document since Secretary [Melvin] Laird introduced what I consider fiscal reality into the cycle. With the Secretary's fiscal guidance introduced early in the FYDP updating process, procurement plans and alternatives must be carefully reviewed and constrained to fund availability. These decisions are reviewed at several milestones in the Planning-Programming-Budgeting cycle.

The final FYDP contains a detailed Procurement Annex listing acquisition plans for the future five years. This feature facilitates a long range review of procurements, affords visibility to changes, and dictates that changes be properly justified.

The budget review provides a more direct form of control over the procurements scheduled in the budget year of the FYDP. The review is performed jointly by my office with the Office of Management and Budget [Executive Office of the President]. Also participating is the Office of the Director of Defense Research and Engineering, and any other Assistant Secretary of Defense having a particular interest in a given acquisition. During this review, procurement plans are rephased or rebalanced to conform to the latest fiscal guidance and requirements. The status of production schedules is verified, and a final pricing check is done.

For each major acquisition, the system provides for a Development Concept Paper (DCP) to be prepared showing the production quantities scheduled in the FYDP, the mission capability required, and an independent cost estimate by the Assistant Secretary of Defense (Systems Analysis). Frequently the DCP also lists design/capability options and the budgetary impact of the tradeoffs between the options.

After the DCP is issued and approved, major acquisitions fall under the Selected Acquisition Report (SAR) system. . . . Since the SAR is one of our more significant and useful controls, I will deal with it in some detail.

Selected Acquisition Report

The SAR is a standard, comprehensive, summary status report on major acquisitions for management. The report was developed specifically to meet the requirements of management control within DOD as well as stated Congressional review needs. The report has seven sections:

- Descriptive Cover Sheet.
- Summary and Highlights Page.
- Operational/Technical Characteristics.
- Schedule Milestones.
- Program Acquisition Costs.
- Contractor Costs.
- Additional Procurement Costs.

Trends in Defense Procurement

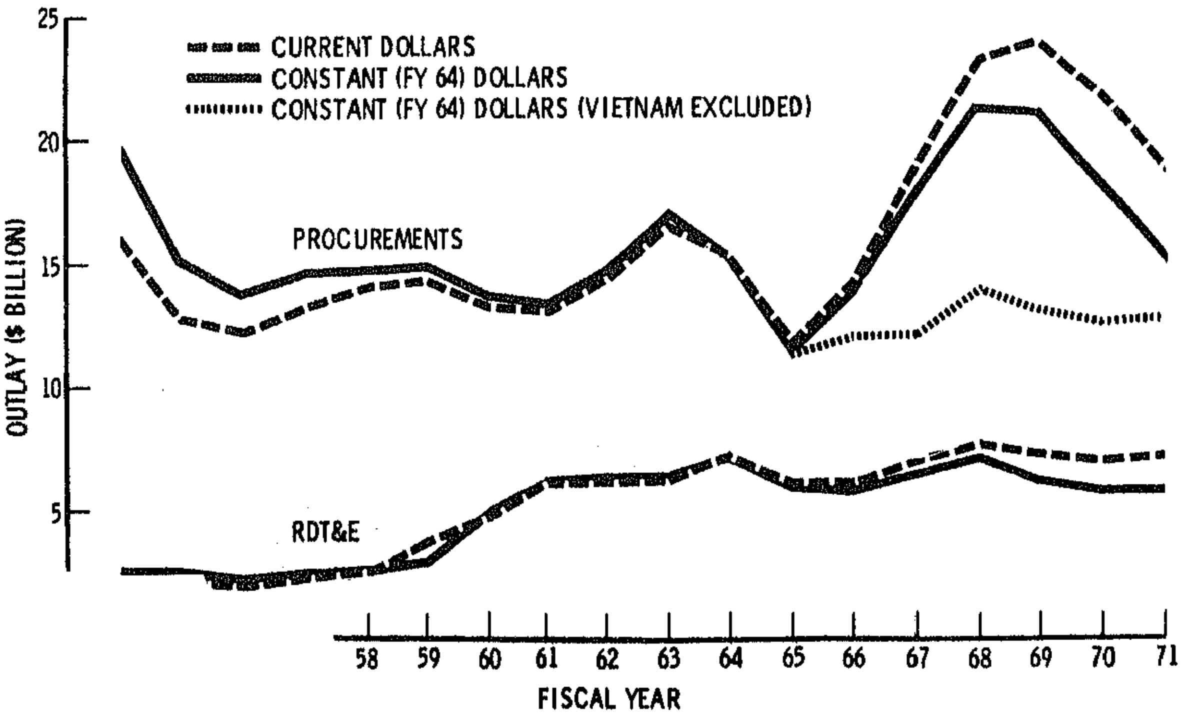


Figure 1.

The technical, schedule and program acquisition cost sections are the central parts of the SAR. These sections show current estimates compared to planning estimates and development estimates, and require analysis of the reasons for any variance from the earlier plans. Demonstrated performance is also required in the technical section. The contractor cost section also contains current price estimates, both government and contractor, and compares them to original contract prices.

SAR reports are prepared as of the end of each calendar quarter by the project managers and are submitted through the Service Chief and Secretary to the Secretary of Defense. The Secretary of Defense then forwards selected reports as requested by the Senate and House Armed Services and Appropriations Committees for information. The General Accounting Office also receives copies of the SARs. As of June 30, 1970, 56 programs were included in the SAR system, and 36 of these were being regularly reported to the Congress.

* * * * *

The format and procedures which are now in effect for the SAR system are reflected in the version of DOD Instruction 7000.3 which became effective on June 12, 1970.*

Several benefits have come from the SAR.

The first benefit is that the Secretary of Defense and the Congress are now able to monitor the progress of the DOD major acquisition in a standard, comprehensive, regularly recurring fashion.

Another benefit of the SAR has been to make DOD aware of shortcomings in its planning and to reveal improvement opportunities. For example, to a great extent DOD now has a consistent policy to deal with inflation in program costing, has defined precisely what cost categories are considered part of program acquisition cost, and exactly what are planning estimates and development estimates because of the SAR.

A third effect has been to reveal potential improvements in the management systems of the DOD. In its role as a passive status report, the SAR frequently shows that decision documents require updating or are not consistent.

A fourth benefit is that the SAR provides a common data base. No longer is it necessary to discover what is, or whether there is, a latest estimate of the cost, schedule, or technical performance of a system. The facts of a situation are clearly and consistently presented in the SAR.

The fifth benefit is that management attention is directed on the problems by the SAR. The report closes the feedback loop and compares actual to plan. When a system is not going according to plan, then top level management is directed to the problem. In this manner the SAR relates to the Development Concept Paper. The DCP is a decision document which contains technical, schedule, and cost estimates with certain review thresholds. The estimates from an approved DCP constitute the planning and development estimates for the SAR. The quarterly SAR compares the latest estimates to the plans. If a threshold is broken, it is disclosed in the SAR and a Secretary of Defense review is initiated.

Audit Reviews

Another form of financial control results from the effort of the Defense Contract Audit Agency (DCAA). This agency reviews contractors' proposals on all major acquisitions to assess estimated costs represented by the contractors. It determines the adequacy of contractors' accounting and financial management systems to ensure that proposals, estimates and statements of costs incurred are developed from acceptable source data. DCAA also assists contract administrators through advice on the validity of incurred costs, adequacy of financial aspects of contract provisions, adequacy of contractor accounting and procurement systems, and adequacy of property controls. This assistance is rendered through on-site auditors on major acquisitions.

C/SCSC

One of the major efforts designed to improve financial management in the systems acquisition process centers around the Cost/Schedule Control Systems Criteria (C/SCSC). These criteria represent DOD standards for acceptability of the internal systems used by contractors to plan and control program costs and schedules. The objective of the criteria approach is to make maximum use of the internal management systems which the contractor has designed to satisfy his needs, rather than to impose a rigid DOD system on him. The criteria set forth the capabilities that a contractor's management system should possess and define the data elements which the system must be able to produce. Effective implementations of the criteria call for only top level summaries of such data to be provided to DOD program managers. By applying criteria rather than specific management systems, we give the contractor needed flexibility in determining how he will meet DOD requirements.

The current set of criteria is the product of an evolutionary development which began in the early 1960s after unsuccessful efforts to implement the PERT cost system. While most people readily acknowledge the inherent advantages of stating requirements in terms of criteria, rather than by detailed procedures or methods, considerable misunderstanding of our real requirements also exists. Criteria which are too broad can be met by systems which still may not produce acceptable data. Criteria which are too rigid can produce a situation where only one specific type of system can meet the requirements. While there is undoubtedly room for additional improvement, the existing criteria have remained stable for almost three years and we do not foresee substantive revisions in the immediate future.

To date, the military services have placed the performance measurement requirements on nearly 60 contracts. They have performed nearly 50 evaluations of contractors' systems and have accepted 13 systems as fully complying with the criteria. We expect to see several more validated within the next few months.

**DOD Instruction 7000.3 may be obtained without charge, one copy per request, from the Naval Publications and Forms Center, Attn: Code 300, 5801 Tabor Ave., Philadelphia, Pa. 19120.*

With all three military departments now actively involved in the evaluation review process, plus prime contractors passing the requirements along to major subcontractors, it will not be long before almost every major defense contractor in the country will have been exposed to the criteria requirements to some degree.

Therefore, we will soon begin to place greater emphasis on the maintenance and surveillance aspects of the program. Our long-range objective is to make C/SCSC implementation and validation a normal routine part of the contract administration function performed by the Defense Contract Administration Services [of the Defense Supply Agency] and our military plant representatives and DCAA auditors. This would eliminate the need for the initial demonstration review process and reduce the overall effort required by the Services to support the program. The Services are currently developing joint procedures and training material which will contribute to achieving this objective. In fact, a Joint-Service Implementation Procedures Manual was published in August by the Joint Logistics Commanders.* Additional materials designed to improve understanding of DOD requirements are in the final stages of development.

Impact and Plans

It is clear that the new policy will result in improved cost estimating prior to production since we will know much more about a weapon system before it enters production. At the same time, there will probably be a longer period of time between initiation of development and full production, and certain budgetary implications could result. For example, we might expect more proposed systems to attrite after a period of initial development. Those surviving the various review milestones would recur through several budget cycles as their development progresses. Costs could be spread over a longer time and thus would be subject to more review if considered appropriate by Congress or DOD. Weapon system decisions will be based upon more realistic cost data, and priorities within available resources will be more accurately established. I also expect that through earlier assessment of total system costs, DOD will have an opportunity to forego sunk costs in cases of questionable potential or of unacceptable cost effectiveness.

As I mentioned, we are continually improving the Selected Acquisition Report. It is also our intent to use SAR data to improve and update other management systems affected by the SAR, especially DCPs. Lastly, I must emphasize that we in DOD are constantly searching for new ways to use SAR data to operate more efficiently in the weapon acquisition process.

Much of the so-called "cost growth" is directly attributable to poor cost estimates. If DOD is to have the information necessary to make the proper management decisions early in the acquisition process, we must improve our initial cost estimates. To this end we are presently building up and standardizing a data base derived from past cost experience, developing improved estimating procedures, and encouraging independent cost estimates. We are working to implement the Cost/Schedule Control Systems Criteria which makes optimum use of the contractors' internal management systems to monitor DOD contracts. By providing for the division of a contract into a logical work breakdown structure, the Cost/Schedule Control Systems Criteria will improve our cost estimates, and make it easier to match costs with the work completed throughout the life of the contract.

We are considering changes in the DOD contract financing policy which would tighten up contract financing procedures by providing for a more explicit statement of financing terms in the contract and increasing the visibility of DOD contract financing costs. These changes will result in DOD expenditure savings and will ensure that a contractor has an adequate cash investment in his DOD contracts.

**Cost/Schedule Control Systems Criteria Joint Implementation Procedures is available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Order No. D 301.35/3:173-3; price 70¢.*

Solid State Microwave Transponder Developed

High peak power—from 100 to 150 watts—solid state microwave generation is being used for the first time by the Air Force in a specialized military navigation beacon scheduled for initial evaluation test before the end of the year.

The advancement was reported by AFSC's Rome Air Development Center (RADC), Griffis AFB, N.Y. Along with Cornell University researchers, RADC has used solid state technology in Limited Space-Charge Accumulation (LSA) for the past four years. LSA is a solid state, radio frequency transmission source.

RADC engineers applied solid state technology in the design of the new land-based beacon containing a dual transmitter and receiver for communicating with navigation radar equipment in aircraft. The beacon, or transponder, receives or transmits signals when it is activated by a radar signal from an aircraft at either X or Ku band frequencies.

The new transponder is unique, according to RADC engineers, because it is completely solid state, and fulfills a multiple capability needed for current and future aircraft operational requirements.

Early beacons were designed to operate in X-band radar frequencies, while late model and probably future Air Force aircraft will be equipped with Ku frequency navigational equipment.

In preliminary studies the LSA has revealed a vast improvement over the magnatron tubes previously used for radio frequency power generation. The LSAs also appear to have a life expectancy well in excess of the magnatron's 500 hours.

LSAs, compared to magnatrons, operate with a greatly reduced input power requirement. This permits dual capability in approximately the same size package as current single band beacons, with comparable on-the-air requirements.

The new beacon was built under a contract to Vega Precision Laboratories, Inc., Vienna, Va., with Cayuga Associates, Ithaca, N.Y., one of the leaders in LSA development, as subcontractor.

Army Missile Command

Year of Change

Major General Edwin I. Donley, USA

The massive task confronting the Army in the immediate future, succinctly and accurately summarized in the phrase "doing more with less," demands innovation at every level of the service.

Imaginative application of new technology has long been a trademark of Redstone Arsenal, home of the U.S. Army Missile Command. The men and women who manage the Army's missile and rocket programs also made substantial contributions to two of the past decade's major technological undertakings: space exploration and ballistic missile defense. Today they are passing a personal test as severe as any they have ever imposed to evaluate the quality of their missiles.

They are adapting their methods of doing business, their organization and their many individual talents to meet a series of challenges triggered by reductions in defense funding and manpower that have made 1970 a year of unprecedented change.

In addition to managing the ongoing missile program and all that task entails, the command, by the end of this calendar year, will have reduced its civilian work force by 15 percent, reorganized, and implemented its portion of PROMAP-70, the Army Materiel Command's (AMC) major new program to improve the materiel acquisition process.

Since most of the Materiel Command's other major commodity commands are undergoing similar changes in 1970, what is happening at Redstone Arsenal bears examination both for its immediate effect and what it may portend in the relationship between the Missile Command and the aerospace industry upon which it depends for the advanced weapon systems it manages for the Army.

The Army, traditionally, has relied heavily on its own in-house competence as a cornerstone of its management technique.

Not many years ago, that technique of management was a source of continuing suspicion on the part of the aerospace industry. The fear, sometimes stated, that Redstone Arsenal would become in fact as well as name "the missile arsenal" and therefore an outright competitor with industry lingered even after the Army transferred its in-house fabrication capability, at Redstone, to the National Aeronautics and Space Administration in 1960. It seems finally to have been put to rest in 1965, when the Missile Command, after careful evaluation of competing concepts for a missile assault weapon, chose an industry version for development in preference to a concept originating in its own laboratories.

Those in industry who might fear a turn to Army in-house development and production of missile systems as a result of a tightening budget need not be concerned. The Missile Command is intensely interested, however, in preserving its own management capability, a resource carried almost entirely in the minds of its people involved in missile research, development, procurement, supply and maintenance. That's why an impending reduction within the civilian work force posed the first and toughest of the many challenges faced by the command this year.

Never as heavily involved in support of Southeast Asia as most of AMC's other commodity commands, the Missile Command experienced no large buildup in civilian personnel after 1965. Military personnel strength has been relatively stable for 10 years, about 1,100. Beginning in 1968 at a level slightly below 10,000, however, the civilian strength began to drop off. Between June and December of 1968, the Missile Command lost 430 civilian spaces; in the next 12 months, 400 more. Both directed reductions were handled through normal personnel attrition. In March of

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this year, the command received direction to reduce a further 1,117 spaces by June 30. A formal reduction in force began.

The man who coined the phrase "personnel turbulence" must have had in mind what occurs in a large organization when Civil Service procedures are invoked to reduce the civilian work force. He caught it all in two words. Accomplishing the reduction of 1,117 involved many more individuals than that number would indicate. About 2,400 civilian employees were affected in one way or another by the reduction in force due to downgrading actions, reassignments, transfers to other agencies, and separations. Despite the large number of persons involved, a vigorous outplacement program, numerous retirements and other planned management actions, resulted in less than 250 full time civil service personnel being actually separated from government service to reach the new manpower ceiling.

Full Disclosure Policy

Operating in the belief that men and women given cause to worry about the permanence of their jobs are seldom able to concentrate completely on their work, the Missile Command adopted a policy of maximum disclosure in its dealings with its people, the Federal employees union which represents them and the North Alabama communities where they make their homes. No one liked what he heard, but no one had reason to doubt that he heard it straight.

Confronted with a similar need to reduce its work force, industry has certain latitude in selecting who goes and who stays, a choice not available to the government manager. In the Missile Command's experience, management creditability was increased by an early policy decision, rigidly adhered to, to conduct the reduction in force by the book. This meant liter- ...ceptions, a fair procedure ...one for managers to live ... are bor- ...he Civil ... based ble, may have a basis in logic, but none in law.

On July 1, as a result, industry found new faces in many familiar places at the Army Missile Command.

Reorganization

Once the personnel changes were completed, the places began to shift as well, as the Missile Command realigned its organization to conform to the standard organization structure recently adopted by AMC for all its commodity commands. The realignment is to be completed by the end of this year as a necessary step preparatory to the use of standard management information systems throughout AMC.

The Army Missile Command's new organization, shown on the accompanying chart, represents no drastic turn away from the past; rather it is a modification of the structure under which the command had been operating. The concept of vertical management pioneered in the Army missile program and later formalized and refined in the project/product management technique within the entire Materiel Command is being continued on each of the Missile Command's major weapons programs, although project management office staffing has been reduced by about 20 percent. Dragon, Hawk, Lance, Pershing, SAM-D, Shillelagh and TOW are systems directed by project managers chartered by the Secretary of the Army. A project manager also directs Air Defense Control and Coordination systems and target missiles.

A product manager—chartered by the commanding general, AMC—directs the Land Combat Support System.

Three special items managers have been added in the new organization. The Land Combat Special Items Management Office will oversee continuing support for the operational Sergeant and Honest John systems as well as managing the aircraft weapons program. Responsibilities of a counterpart operation for air defense will include the Redeye and Nike Hercules systems, both discontinued as project managed weapons earlier this year. The Chaparral Air Defense System will be run by a separate special item management office.

In the command group, the Missile Command will be operating with one Deputy Commanding General instead of two as it once did. Formerly the command had two deputy commanders, colonels in charge of Air Defense Systems and Land Combat Systems. The posts have been retained as special assistants to the commanding general in the new organization with similar responsibilities.

Principal staff offices are in line with similar organizations of comparable size within the Army. The Missile Command Legal Office now combines both procurement law and military law within one office, functions formerly carried on in separate shops. Industry will find the Missile Command Patent Center a part of this combined function.

The Directorate for Management Information Systems, first element of the new organization to be activated, centralizes all command automatic data processing activities. Another totally new organizational element, the Directorate for Plans and Analysis has responsibility for all long range planning and emergency planning. It also picks up systems analysis formerly carried out in the Research and Engineering Directorate.

Acutely aware of the need for quality in all phases of missile operations, the Missile Command has long operated with centralized overview of quality control, now brought to an even tighter focus. Everything connected with the word in an organizational sense has been consolidated in the new Directorate for Product Assurance which, building on the 50-man nucleus of the former Product Assurance and Test Management Office, has added almost 300 other quality specialists from other elements of the old organization.

The buying portion of the "doing" operation, executed by the Directorate for Procurement and Production, remains virtually unchanged. Functions pertaining to configuration control and standardization formerly carried out there, however, have been transferred to the Directorate for Research, Development and Engineering.

Industry will note extensive changes both in the names and internal alignment of the command's research and development setup and

supply and maintenance operations. The former is oriented primarily to the concerns of tomorrow and the latter to those of today—support of operational missile and rocket systems used not only by the U. S. Army, but by numerous allied nations as well.

Supply and maintenance operations, traditionally carried on in the command in a single organizational element have been split. The Directorate for Maintenance handles all missile maintenance including publications and technical assistance. The Directorate for Materiel Management assumed the missile system supply functions as well as overall responsibility for materiel readiness.

On the research and development side, the directorate reorganized with five major offices. Establishment of the Systems Integration and Engineering Office was a move designed to improve the command's ability to provide engineering support to project managed systems and to establish an engineering base to support systems no longer in production but still in active use. The Advanced Systems Concepts Office replaced and carried on most of the functions formerly performed by the discontinued Future Missile Systems Division. An Advanced Research Projects Agency Support Office serves as the command's interface with the Advanced Research Projects Agency of DOD and acts as ARPA's agent in administering many research tasks. This mutually beneficial association, dating back more than a decade, has resulted in substantial advancement of missile technology, particularly in such areas as electronics and propulsion systems.

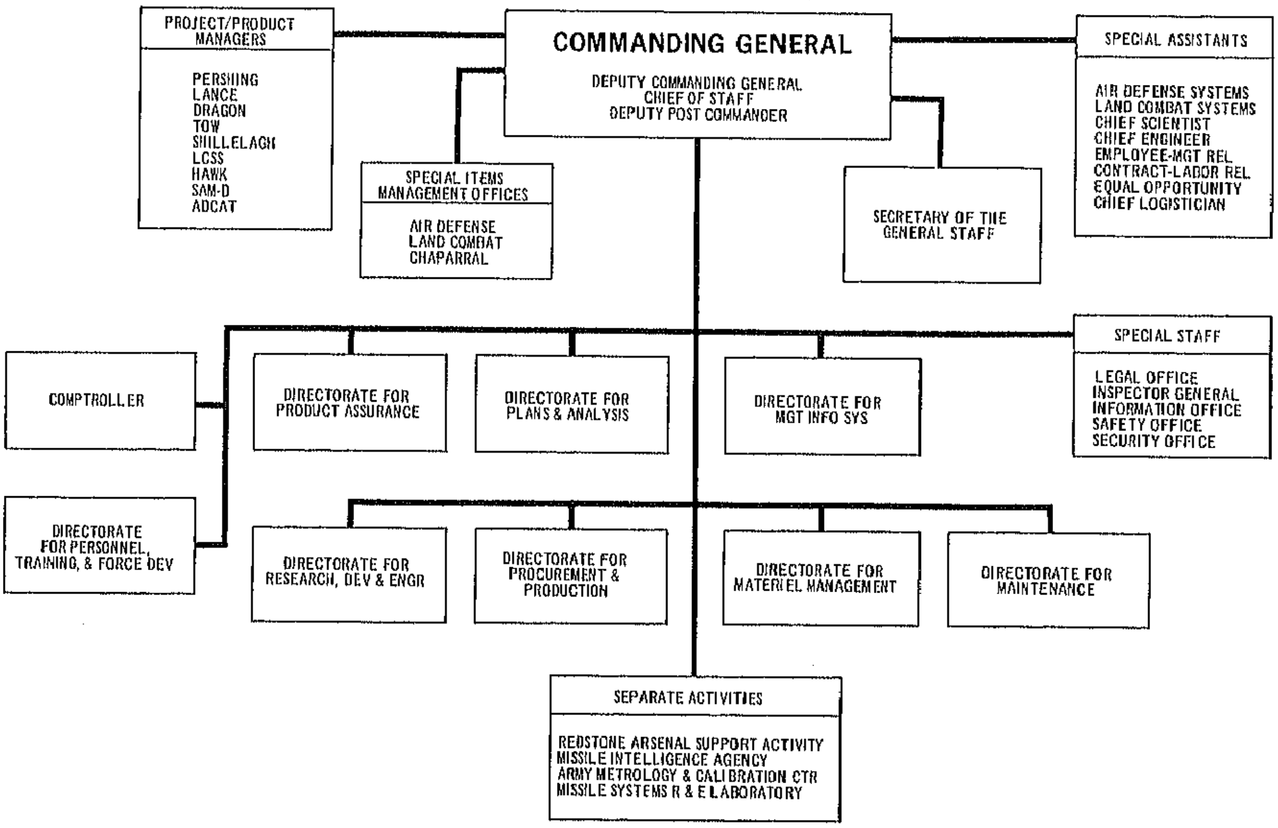
Other offices in the directorate include one for Program Coordination and Support, and the Redstone Scientific Information Center.

The command's research and development laboratories have now been established—largely for administrative purposes—as a separate Class II activity collectively known as the Missile Systems Research and Engineering Laboratory. This element, in turn, has been subdivided into seven major areas, each headed by a civilian director. Functions formerly carried out in two of the Missile Command laboratories, the Ground Support Equipment Laboratory and the Structures and Mechanics Laboratory, were consolidated under the Director of Ground Equipment and Materials. The areas of responsibility of the other directors are evident in their titles and include: aeroballistics, physical sciences, propulsion, advanced sensors, guidance and control, and test and evaluation.

The laboratory operation and its experienced staff represent a technical competence in being that the Missile

U. S. ARMY MISSILE COMMAND

REDSTONE ARSENAL, ALA. 35809



Command has always felt absolutely essential to the successful accomplishment of its mission. The laboratory group essentially performs three tasks: evolving new technology and adapting it to Army needs; trouble shooting technical problems that may arise in on-going systems; and evaluating the technical proposals and competence of Army missile contractors.

The other command elements listed in the bottom block of the accompanying organization chart are also established as Class II activities and deserve a few words of explanation.

The Army Metrology and Calibration Center has the total Army mission for calibration and metrology, while the Missile Intelligence Agency works directly with higher authority and the intelligence community in analyzing and evaluating foreign missile systems and missile technology.

Support services to all the Army activities located at Redstone Arsenal and in nearby Huntsville are the responsibility of the Redstone Arsenal Support Activity.

Redstone's 38,000 acres provide a home for the Army Missile Command, which alone among AMC's commodity commands enjoys the particular advantage of having all its major activities on one installation, as well as the U. S. Army Missile and Munitions Center and School, and the Marshall Space Flight Center of the National Aeronautics and Space Administration. The Marshall Center, which observed its tenth anniversary in July, is NASA's primary space launch vehicle manager. The center and school, reporting to the U. S. Continental Army Command, annually trains thousands of soldiers in missile and ammunition maintenance.

Also drawing some support from the Missile Command are three Army agencies located in the Huntsville Industrial Park just north of the arsenal. The Safeguard Systems Com-
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mand and its predecessors almost from their inception 25 years ago.

The series of decisions tracing back more than two decades, which sited in the same area all Army activities with primary interest centered in the technology of missiles and rockets, had a sound basis in the logic that close proximity of management and technical teams would provide a beneficial interchange of ideas and technology. Those decisions also transformed an entire area of the Tennessee Valley. The economic impact was massive. Today the Army agencies at Redstone and Huntsville support a payroll of approximately $180 million. The Marshall Center adds about $90 million more. The Missile Command, after a reduction in force of more than 1,000 jobs, still offers full time employment to almost 8,000 civilians. Together with the other Army agencies and the Marshall Center, Federal missile and space activities directly employ twice that many. Yet cutbacks in space and defense spending have had major impact in the community. Aerospace contractor employment had dropped by several thousand before the Army civilian cuts began.

Community Diversifies

Civic leaders in Huntsville and North Alabama have responded to the challenge of declining space and defense spending with a highly successful effort to diversify their industrial base. Forewarned by declining aerospace employment as NASA contracts began to phase out in 1968, Huntsville began an aggressive effort to attract non-aerospace industry.

Last year, although the community lost 2,700 jobs—primarily in aerospace—it added 3,000 new ones in non-aerospace industry for a total gain of about 300.

The Missile Command, which had long urged diversification upon its neighboring civilian community, has not forgotten that lesson as it faces up to a future made uncertain by change. The answer to the obvious question: "How do you diversify a major AMC commodity command?" is that you don't, at least not by product. What you do with the people available and their individual talents, however, provides the key to how the military and civilian personnel of the Missile Command are responding to the many challenges of 1970.

In a word, you innovate. You look for new missions, get in shape to accept them, and move out smartly when they come along. Further, if you understand the realities of declining defense spending, you find ways to do a better job.

Search for Better Ways

The search for the better way has been formalized in PROMAP-70, AMC's implementation of the major Army effort now underway to improve the material acquisition process. Tackling its portion, the Missile Command has carried forward some good ideas of the past, added some new ones. Almost all will bear directly on the command's future dealings with industry.

Fly Before Buy. The most noteworthy impact of technology on Army missiles in the past decade has been a trend to decreasing size. A decade ago, most Army missile systems were characterized by low density and high individual cost. Technology now at hand has permitted the Army to translate the dreams of the missile pioneers into hardware with a new generation of small, high accuracy tactical warfare weapons, among them the shoulder fired Redeye ground-to-air heat seeker; Shillelagh, fired from a tank gun and automatically guided to the gunner's point of aim; and the wire guided TOW heavy assault weapon which has proven readily adaptable to launch from a ground mount, a variety of vehicles including jeeps and armored personnel carriers, and helicopters. All these small missiles are being procured in large quantity.

A Fly Before Buy demonstration, instituted in the Shillelagh program in follow-on production orders, was required in TOW from the first production buy. Randomly selected missiles, taken from each production lot, are now being fired regularly at a Redstone Arsenal range and must demonstrate acceptable performance before the Government buys that production lot. Industry can expect a similar requirement in future production of relatively low individual cost, high density missile systems.

Should Cost. Early this year, AMC

charged the Missile Command with conducting the Army's first Should Cost study, selecting a sole source missile procurement for the pioneering effort. The Missile Command provided several key people on the 26-man government team which conducted a 2-month study with the full cooperation of the contractor. The objective of this technique, new to Army procurement, is to allow the Army to make a realistic evaluation of a contractor's proposal by determining the soundness of his estimated costs. Industry can expect to see it applied in the future on major, sole source, high dollar contracts.

Historically the Army has used the contractor's proposal as the base line for negotiations in coming to terms with him. Government negotiators looked at available price history, allowed for known price variations and negotiated accordingly.

The Should Cost technique differs from that approach in that a careful examination is made of the contractor's management and production practices and, indeed, anything else in his operation which contributes to the cost of the hardware. The resultant independent estimate of what the procurement should cost is then applied as the baseline for negotiations.

If the study identifies the uneconomical or inefficient practices in the contractor's operation, he is expected to make necessary improvements and cut costs accordingly. There is no intent to set up an idealistic cost by determining what the price tag should be if the items were produced under the most favorable conditions. The Army does seek to eliminate, through the vehicle of the contract, inefficient practices which may have been accepted in the past.

Production Management Reviews. Although still evolving, this technique of systematic hard looks at a producer before committing an expensive system to quantity production is a trademark of Missile Command management. Problems that develop once production is underway almost invariably add substantial cost and lost time. These reviews are one means that has proven effective in surfacing problems and resolving them before metal cutting begins. The technique brought to light some 20 deficiencies that could have caused real trouble on the first major system the Missile Command tried it on. Basically it involves four on-site reviews, by a command team, of the contractor's capability to produce the desired end item within cost and time constraints. The first, while the system is still in development, concentrates on design stability, documentation and configuration control, development and reliability test results, and in general is aimed at determining if the system is ready to proceed to advanced production engineering. A few months after that phase begins, a second review checks progress. A third is made as advanced production engineering is winding up and determines if results fully support the on-coming production program. Finally, early in production but before hardware is produced, a fourth review checks documentation control, plant layout, acquisition of equipment and special tooling, and other areas of interest.

A Dragon anti-armor and fortification missile clears its shoulder launcher during early developmental tests.

Although the three examples cited apply primarily to major systems contracts, industry and business can also anticipate increased Missile Command effort to make available dollars go further in the procurement of missile repair parts. Missile repair parts expenditures annually average between $75 and $100 million, about 15 percent of the total value of contracts awarded by the command. In terms of annual workload, however, they account for almost 75 percent of the 20,000 yearly contract average. There have been recent developments in both the manner in which these items are contracted for and how the Army handles what is produced.

A technique called Accumulative Quantity Requirements Contracting is now a feature of more than 100 active Missile Command repair parts contracts. A bidder is requested to quote unit price on a specified lot for immediate delivery as well as unit prices for additional orders for the same item within two years. Normally the price comes down on succeeding orders. Should his quote be accepted, the bidder is assured any orders for the

item for a period of 24 months in addition to his initial order. The Missile Command pays an adjusted price based on the total order over a period of two years.

Suspicious at first, industry now accepts this contract which allows the producer to take advantage of quantity discount in the purchase of his materials. By amortizing his non-recurring costs on the initial quantity ordered, he can then drop his price on the remainder by eliminating recurring set up costs and taking advantage of his increased skill to produce the item. The Army obtains lower costs and avoids the expense of repetitive solicitation and contract award as well as repetitive first article testing which averages about $200 per test each time it is necessary to qualify the work of a new producer.

First article testing, in turn, is one of three positive checks the Missile Command is using to improve the quality of missile repair parts in the Army supply system. This is in an effort tracing back to 1962, now broadened to include a depot receiving inspection program and a continuing check on materiel already in storage awaiting issue to operational missile units.

Under original practice, once an initially produced item had passed first article inspection, remaining parts in a lot were shipped direct from the manufacturer to an Army depot, packaged for subsequent individual issue to operational missile units. When the command sent teams into the depots to begin checking new parts as they were received from manufacturers, it quickly became apparent that a significant number of parts being received failed to meet quality standards.

The origin and type of defective items uncovered in first article test and in the receiving inspection program provide a starting point for the third part of the program, a check of material already in storage.

Some of the defective items can be repaired on the spot, others must be returned to the producer for reworking or replacement. This still expanding program has an obvious potential for substantial savings, but the real reason the command is pushing hard is to ensure reliable parts feeding into the supply system as replacements for the field.

None of these steps are particularly new or startling, nor are they panaceas for the problems of the day. It is a peculiar feature of most ways that produce positive results that they look, upon close examination, to be little more than applied common sense.

The kind of common sense, for example, that instinctively says one way to find out if a producer of repair parts is going to deliver on time is to ask him. The Missile Command cut late deliveries of repair parts from 35 to less than 5 percent by doing just that. A form letter is sent to each of its suppliers 90 days in advance of the delivery, reminding them of the expected delivery date, asking them to report any problems, and following up promptly. This has proven to be a most useful technique, particularly in dealing with small businesses, many of whom are working on their first government contract, are unfamiliar with the way of doing business and, in a few instances, have difficulty reading drawings.

The innovative, yet common sense approach to the problems of today, has also been applied in charting a course for the development of missile systems to meet future Army requirements.

The Army Missile Plan is a document developed by the command that interested industry will be hearing a great deal about in the next few years. It is used to formulate the command's research, exploratory development and advanced development program. Primary intent of the plan is to key the programs managed by the command laboratories to the requirements of the user. It presents a time phased analysis of the technical areas to be investigated and the resources required to achieve weapons meeting future requirements of the Army.

In its present version, the plan is based on 15 approved or potential weapon requirements and evaluates 70 system design options that might achieve the requirements.

An attempt has been made to assess the relative priority of the requirements and to spell out the component technical tasks that must be accomplished before specified new systems can begin a contract definition phase.

Oriented to systems and technology, the plan is based on both the officially approved and the potential future requirements of the Army. It provides system and subsystem options rather than single high risk approaches. Finally the plan places the required systems in a priority listing based on a combination of factors, user priority, technology availability, and the needs for replacement of operational systems.

All in all the plan tells a great deal in a single classified document about where the Army missile program stands, where it hopes to go in the next decade, and the hard tasks that must be accomplished along the way.

Industry may request a copy, establishing a need to know, by addressing the Director of Research, Development and Engineering, U. S. Army Missile Command, Redstone Arsenal, Ala. 35809.

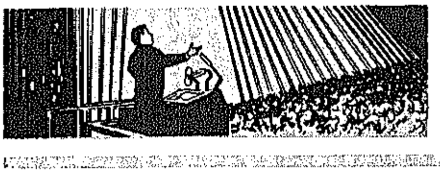
New Personnel Rescue Technique Being Tested

A technique designed for quick rescue of downed airmen and other personnel is being tested by the Aerospace Medical Research Laboratory (AMRL), Wright-Patterson AFB, Ohio.

Tests to date have used an Army U6A aircraft with 2,000 feet of tubular woven half-inch line to pick up instrumented anthropomorphic dummies. Tow tests of human subjects are expected to begin this fall at El Centro, Calif., in conjunction with man-rating systems using the principles of free-fall and circling lines to retrieve men and equipment.

Additional testing with anthropomorphic dummies will precede the live tow tests at El Centro. The Navy also is working on a similar system, called the Ground Anchor Delivery System, which would employ longer lines and high speed jet aircraft. The Navy and Air Force are cooperating in the ventures and test data from both systems will be used at El Centro.

Testing to date of the Air Force technique, called the Long Line Loiter System, indicates promise according to Colonel John Simons, Chief of AMRL's Flight Environments Branch.



FROM THE SPEAKERS ROSTRUM

The Threat

Excerpt from the address by Hon. John S. Foster, Dir., Defense Research and Engineering, at Air Force Association annual convention symposium on "The Threat," Washington, D.C., Sept. 23, 1970.

I want to define the term "threat" to include all of the weapons of a potential adversary and his capability to use them against us—that is, a comparison of forces on both sides—and the trends which show what we can expect his capabilities to be in the future.

There are, of course, "threats" from many countries. But the Soviet forces so overshadow those of all other potentially hostile nations that we can logically use the Soviet Union as the one nation against which we must measure our capabilities.

If you make all of these assessments as of today, without any wishful thinking, I am convinced that one comes to two conclusions:

- **In the kinds of weapons that count most, both nuclear and non-nuclear, the Soviets are going ahead on quantity.**
- **On quality, it's a horse-race, with the United States now ahead by a neck, but falling back.**

Having made these sweeping generalizations, let's go back now and examine some of the details. I'll start with present strategic capabilities.

In a broad sense, there is still rough strategic parity between ourselves and the Soviets in numbers of offensive weapons. They have more land-based missiles than we—more than 1,300 launchers operational, compared with our 1,054. We have more submarine-based missiles than they—41 U.S. Fleet Ballistic Missile submarines operational, compared with approximately 13 operational Soviet submarines of the Polaris type and at least another 15 under construction or outfitting. We don't know, of course, when they will stop building those submarines or the ICBMs. We, however, stopped adding to both our land-based and submarine strategic missile forces several years ago.

The Soviets are still constructing new land-based missiles. There are now more than 300 of the large SS–9s operational or under construction and their Minuteman-sized SS–11s and SS–13s—more than 800.

They are building new missile-carrying submarines at a rate of about eight a year.

In long-range bombers we continue to lead in numbers—unless you assume that the 700 Soviet medium bombers and tankers would be used on one-way missions.

In strategic defense, there is no parity. The Soviets have long been defense-minded and have today an ABM complex operational around Moscow, as well as many thousands, on the order of 10,000, surface-to-air missiles already deployed.

In non-strategic areas, they are impressively active in the tactical aircraft field. Naval tactical forces are also on the increase, as any recent reading of the papers will reveal. They are operating in the Mediterranean, the Caribbean and briefly in the Gulf of Mexico.

But now, let's look beyond the present and near-term future and attempt to describe the kind of situation we will have in 1975 if present U.S. and Soviet trends continue.

To place the U.S. trends in perspective, I would like to remind you that we now are in the process of reallocating the total resources of Government—local, state, and federal—to place greater emphasis on areas which heretofore have been too much neglected. The effort to reverse the trend towards environmental pollution is but a single example. It may be interesting and suprising to note that national public spending—federal, state and local—is far greater on our non-defense needs—on the "quality of life" as it is often put—than it is on defense. Since 1964, in fact, total public spending on civil programs has increased by the equivalent of two Defense Department budgets.

Dr. John S. Foster Jr.

The growing Gross National Product provides most of the extra money for civil needs, but it has been necessary to provide some of the funds from defense spending. Defense budgets as a consequence have been declining since 1968, and the FY 1971 budget presently before the Congress is, in the words of Secretary of Defense Laird, "rock bottom and bare bones." Yet pressures persist in numerous quarters to shrink the defense budget still further—to direct an even greater share of defense dollars into other channels.

The President's request to Congress this year is about $72 billion. Al-

though it is hard to determine what a ruble is worth, and parts of the Soviet defense budget are hidden, for equivalent defense activities, the Soviets have increased their spending to the present U.S. ballpark and show no signs of leveling off.

A leveling off for us in the low $70 billions would result in a gradual decline in our buying power. Inflation and higher military pay eat into the value of each defense dollar.

We are introducing new efficiencies, but they cannot compensate fully for the money reductions we have seen. Our available money is going down; the Soviet Union's is going up. This means that we will be buying fewer new weapons, the Soviets will be buying more.

Research, Development

The budget squeeze affects all of our defense efforts, but in our examination today of the long-range threat, it is illuminating to look particularly at one kind of spending—research and development. It is today's research and development that provides tomorrow's weapons—for 1976 and beyond. It also provides a capability to understand early and counter quickly the qualitative weapons improvements on the other side.

The picture here is a sobering one.

The Soviet military research and development effort is presently estimated to be 20 percent greater than ours and is growing at an annual rate of 10 to 13 percent. In contrast, in compliance with our overall budget restrictions, U.S. research and development efforts have leveled off and are now declining.

On the assumption that present trends continue, we can visualize the Soviet threat which we could be facing beyond 1975.

First, strategic offensive weapons.

As I have indicated, they can have a greatly increased number of strategic missiles—both land and sea based. If present trends continue, we should expect the ICBMs which they deploy in 1975 to be about the technological equal of our own. The Strategic Arms Limitation Talks (SALT) can influence numbers of missiles, but without a SALT agreement we could trail in numbers.

You are familiar with the quality improvements in the SS–9 ICBM—the large multiple warheads and the good accuracy which the weapon achieves. You may not be familiar, however, with recent tests on their SS–11 missile, which indicate that it, too, is being improved. From what we know now about tests of new configurations we conclude that there are three versions of the SS–11:

- The original one, with a single re-entry vehicle, and now deployed.
- One with a single re-entry vehicle plus penetration aids.
- One which has three separate re-entry vehicles.

In other words, the SS–11 which has been long on numbers but relatively short on quality now is continuing to grow in numbers and achieving significant improvements in quality.

The submarine-based missile force is also of concern. By 1975 or perhaps even earlier, we should expect to see a Soviet submarine missile force comparable to or surpassing our own. This is a sobering thought.

But offensive missile activity is not the only area where an increased threat will lie. As I noted earlier, the Soviets have always been defense conscious. By 1975, we should see an extension and modernization of the Soviet early warning aircraft force deployed beyond the perimeter of the Soviet Union—with interceptors ready to attack our retaliatory bombers long before they reach the Soviet border.

Also, we expect the large numbers of surface-to-air missiles (SAMs) already deployed to be modernized. If a SALT agreement has not stopped further ABM deployment, wè should expect a new generation of Soviet ABM interceptors and sensors. They are now being tested. Further, improvements in automation and other feasible changes may make the SAMs, or a portion thereof, a threat to our missiles as well as to our long-range aircraft.

In summary, in the strategic area, we will face a greater threat in numbers of improved strategic offensive missiles—including missile submarines operating off our shores—and also an improved Soviet defensive network, intended to intercept our retaliating missiles and bombers.

Soviet defenses against our Polaris submarines may also improve, judging from vigorous current Soviet work on antisubmarine warfare techniques and technology. They are conducting extensive antisubmarine exercises in open ocean areas throughout the world. You are probably aware that the Soviet Union has the largest submarine force in the world today. In addition to sheer quantity of submarines, they are also increasing substantially the antisubmarine quality of this force—for instance, through recent additions of several new classes of submarines, including several new, modern high speed attack submarines.

New Submarines Expected

A large submarine construction program continues in the Soviet Union, and one can anticipate the appearance of additional new classes of submarines with enhanced antisubmarine and antiship capabilities by 1975.

The Soviets have complemented their submarines with an extensive surface ship construction program that has produced several new classes of antisubmarine ships, including an innovative helicopter cruiser and several classes of heavily armed escorts. They also have acquired an airborne antisubmarine capability through the development of a new helicopter for surface ship escorts, and the introduction of a land-based, antisubmarine airplane with excellent range and payload capabilities. The Soviets have begun to combine these individual forces into an open-ocean capability which they exercised recently in a coordinated worldwide exercise.

Although I can foresee no specific breakthrough which will pose a serious problem to our own submarine missile force, the possibility is always present. You can imagine our difficulties if something of this sort emerged. And bear in mind, the harder one works on antisubmarine research and development, the greater one's chance of success; and the Soviets are working hard!

But the Soviet Union, while bending its energies to the rapid buildup of its strategic systems, has at the same time not neglected its conventional forces.

The Soviet navy has expanded from largely a coastal defense force to one extending Soviet naval power to oceans throughout the world. In the Mediterranean and other ocean areas readily accessible to the Soviet Union, their navy is active and growing. By contrast, our own presently larger Navy is shrinking and, except in the case of aircraft carriers and nuclear submarines, is a force rapidly becoming obsolescent. By 1975, we should expect to face a large, modern and mature Soviet navy.

There have also been marked efforts to upgrade Soviet tactical air and armored forces. For example, although present NATO and Warsaw Pact manpower and aircraft are about equal in number, the Pact has twice as many tanks and more than twice as many artillery and rocket-launcher pieces, and is rapidly improving its tactical aircraft strength.

The Soviet fighter aircraft are increasing in quality while retaining overall numerical superiority. The Soviet approach to research and development for fighter aircraft provides for a steady pace in applying technology to design. Prototypes are produced from competing design bureaus on a regular basis. As a result, the Soviets have flown a new fighter about every 18 months.

In the past we have met and defeated the Soviets' best fighter aircraft. But there is conclusive evidence that the Soviets have corrected those major deficiencies in their fighters which were revealed in past engagements with our present aircraft. A new model of the MIG-21 incorporates improved maneuverability, more staying power in the combat area, higher speed at low altitudes and improved armament.

The Soviet Foxbat is currently in production and is based on a level of technology that is in many respects equal to the best in the United States.

By 1975 we expect to operate new fighter aircraft systems that will provide to us a margin of superiority over the threat. However, current Soviet developments indicate their intent to continue their steady pace of technological progress.

As our experiences in the Middle East and the Far East show, the lesson is clear. The vast nuclear arsenal of the United States will not deter non-nuclear limited wars. Hence we, and our allies, must not lag in our efforts to be equipped with effective "conventional" weapons as well.

Leadership Fading

I would like now to come back to the issue of research and development. As you know, one must invest heavily in research and development in order to have weapons to match the enemy's. In the past, the United States has had a comfortable edge in the level of defense research and development effort and in the quality of weapons resulting from that process. Our comparative effort has made us confident that we could meet any Soviet challenge in defense, atomic energy, or space.

But the scientific and technological leadership upon which that confidence has been based is fading. The Soviet Union has now created a national research and development base larger than ours—in manpower and spending—and apparently almost equal to ours in quality.

The nature of research and development is such that the problems of falling behind can be multiplied far beyond the simple difference in levels of effort. That is, research and development not only results in new weapons but it also enables us to understand the shadowy evidence of what the Soviets—and others—are doing. Our advanced work in the past has given us a store of knowledge with which we could understand the significance of new Soviet technical advances, and be ready with an appropriate counter when the advance was translated into a new weapon. But should the Soviets become more advanced than we in some area of technology, they could then jump forward while we wondered what the change was all about.

We used to be the ones who made the jumps. In the future, a dangerously large proportion of the surprises could come from the other side, while we scramble to catch up.

Now, I have not covered the entire gamut of the threat, but I have mentioned enough to give you a message. This message is that the path ahead is not easy and not without risk. The best sober judgment of our nation today is that the risk for the present is an acceptable balance against our many non-defense needs.

We must, however, be ever more vigilant to ensure that the money we do spend is spent in a manner to give us the greatest overall gain. We must likewise be vigilant so that we can recognize when the risk becomes too great to be acceptable.

There are those, of course, who say that the Soviets will not attack, that we need not respond to the "threat" which I have outlined here and that we can further reduce our defense spending. Direct attacks on the United States certainly are unlikely if we maintain our retaliatory capability; but as incidents in the past decade have shown, nuclear weapons can play an important role in crises and confrontations, without a shot being fired.

In another crisis we cannot afford to be a poor second in strategic nuclear weapons as was the Soviet Union during the Cuban missile crisis. And we have fought against Soviet non-nuclear weapons in third countries, and must be prepared to face them again if American interests are threatened.

I cannot predict the future. I can only say that we arm in order to diminish the risk of war and the risk of losses in crises and wars. The greater the disparity in quality and quantity of arms between the United States and the Soviet Union, the greater that risk will be—since all the foreseeable disparities will not be in our favor.

Christmas Mail Schedule

The mailing periods for this year's Christmas mail to servicemen overseas are:

- Surface mail—October 12 to November 7.
- Space available airmail (SAM)—October 19 to November 21.
- Parcel airlift (PAL)—October 26 to November 28.
- Airmail—November 30 to December 12.

Mailing within these dates will help ensure timely delivery to overseas destinations.

Industrial Security Program

Colonel George A. Zacharias, USA

The targets of the intelligence services of the Soviet Union and its satellites have not changed. They seek to penetrate the most sensitive agencies of our Government. They seek to collect military, scientific, technical, and political information. They seek to obtain information concerning developments in private industry. They attend conventions and conferences, they make reconnaissance trips and tours, and they subscribe to all manner of periodicals and publications.
—Testimony of J. Edgar Hoover, Director, Federal Bureau of Investigation, before the House Subcommittee on Appropriations, March 5, 1970.

The above quote best illustrates why we have a Defense Industrial Security Program. The purpose of the program is to protect classified information in the hands of industry. Only trustworthy personnel, with security clearances at the appropriate level and a legitimate "need-to-know," are granted access to such information.

The significance of this program becomes more evident when we refer again to the aforementioned Federal Bureau of Investigation testimony. The Bureau Director reported that, as of February 1, 1970, there were 1,129 official representatives of Communist countries assigned to this country, accompanied by 1,497 dependents. This is an increase of 73 percent since 1964. A high proportion of these people are espionage agents.

Purpose

The Defense Industrial Security Program is designed to safeguard classified information released to U.S. industry. In addition to the Defense Department (including defense agencies and the military services), 11 other Federal agencies and departments (User Agencies) use the services and procedures of this program. They are the Departments of State; Treasury; Interior; Agriculture; Commerce; Health, Education and Welfare; Transportation; the National Aeronautics and Space Administration; the Small Business Administration; the National Science Foundation; and the General Services Administration.

The same rules and regulations apply, whether the classified information originates in the Defense Department or in one of the 11 non-defense User Agencies. Uniformity of requirements has resulted in less disruption to industry and a reduction in the cost of administering this one program.

Industrial Security Policy

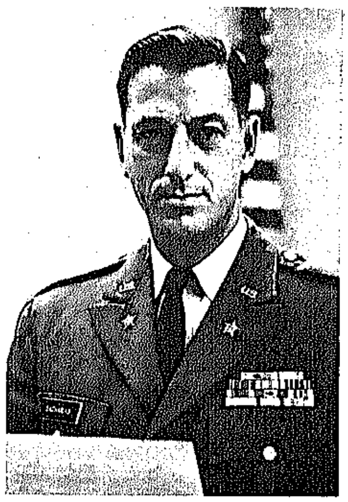
The Office of the Assistant Secretary of Defense (Administration), more specifically, the Deputy Assistant Secretary (Security Policy), establishes industrial security policy. The Deputy Director for Contract Administration Services (DCAS), Defense Supply Agency, is charged with administration of the Industrial Security Program. Within DCAS, the Office of Industrial Security is responsible for directing the administration of and providing technical direction to the Defense Industrial Security Program and for publishing the various regulations and manuals implementing industrial security policy.

Day-to-day implementation of the program is assigned to 11 Defense Contract Administration Services Regions (DCASRs) which have been assigned security cognizance of the cleared facilities within their jurisdiction. At the close of the calendar year, there were 13,225 facilities. During the year 2,248 new facilities were cleared and clearance of 2,375 facilities were administratively terminated—a turnover of 4,623 facilities.

Classification Management. The assignment of a classification category is the first essential step in industrial security. Security classification affects the overall cost and the operation of the program. The level of classification assigned affects controls needed to assure safeguarding of the information. A higher classification requires increased protective measures such as more storage, equipment, security guards, personnel to control handling of material, etc. Hence costs increase.

On the other hand under-classification may jeopardize the security of information. Thus, it may be said that classification management is the hub of the many spokes which constitute the wheel of security.

Central Processing of Clearances. In March 1965, the Defense Industrial



Colonel George A. Zacharias, USA, is Chief, Office of Industrial Security, Contract Administration Services, Defense Supply Agency. Previously he served on the staff of the Assistant Chief of Staff, J2, Military Assistance Command, Vietnam. He has also served as Chief, Industrial Security Branch, Office of the Assistant Chief of Staff, Intelligence, Department of the Army, and as Assistant Army Attache, London.

Security Clearance Office (DISCO), a field extension of the DCAS Office of Industrial Security, was established at Columbus, Ohio, to process all industrial clearances on a centralized basis. Prior to that time, there were approximately 110 separate clearing activities. This centralized administration has proven to be extremely effective.

DISCO currently processes in excess of 650,000 clearance actions annually. On March 5, 1970, DISCO issued its millionth new clearance.

Establish Need. A question frequently posed in the Industrial Security Program is: "How do I apply for a clearance for my firm?" The answer is that an industrial organization cannot "apply" for a clearance. A DOD procuring activity (User Agency) or cleared prime contractor having a procurement need for a firm's product or service must initiate the request to the cognizant security office. Upon receipt of a request, an Industrial Security Representative from the cognizant security office visits the prospective contractor and describes the procedures involved in the clearance process. The representative explains the various forms that must be executed by the facility.

The most important forms are the Security Agreement (DD Form 441) and the Certificate Pertaining to Foreign Affiliation (DD Form 441s). By executing the Security Agreement, the contractor agrees to abide by the provision of the Industrial Security Manual (ISM) for Safeguarding Classified Information (Attachment to DD Form 441).[1]

The required forms are then forwarded to DISCO for investigation of the firm and its management.

In addition to a file check of various national agencies, a facility security clearance requires an extensive inquiry into the management structure of the company to determine if there is foreign ownership, control, or influence. Facilities which are determined to be under foreign ownership, control, or influence are ineligible for a facility security clearance. The facility clearance also requires a clearance of the firm's owners, officers, directors and executive personnel (OODEPs). Each designated official is required to a complete a Personnel Security Questionaire and to submit a set of fingerprint impressions.

When the investigation is satisfactorily completed, the cognizant security office grants a facility clearance and personnel clearances for its OODEPs. Currently, an average facility security clearance processing action takes approximately 40–55 days for a Secret clearance, and approximately 105–120 days for a Top Secret clearance.

Employee Clearances. After a facility is cleared, clearances for employees who require access to classified information in contract performance are necessary. This is accomplished by having those employees complete Personnel Security Questionnaires (including fingerprint impressions). The facility then forwards them directly to DISCO for processing.

At DISCO the screening process begins with a check of the Central Index File (a record of all facilities with clearances, indicating clearance level) to assure that the contractor has a valid facility clearance. Then the task of screening clearance applications moves to the DISCO Processing Division which determines the amount of investigation required. The majority of clearance applications are for the Secret level, which requires a National Agency Check. DISCO requests this check from the Defense National Agency Check Center at Fort Holabird, Md. Should the applicants require access to Top Secret information, Background Investigations are needed. In these latter cases, DISCO apportions the requests for investigation to Army, Navy and Air Force investigative services.

When National Agency Checks or Background Investigations are completed, the findings are screened by the Processing Division. If completely favorable, clearance is automatically issued by the reviewer. If more than minor derogatory information is developed, the case is referred to the Adjudication Division. At this point, standards for a favorable determination, contained in DOD Directive 5220.6,[2] "Industrial Personnel Security Clearance Program," Dec. 7, 1966, are applied. The standard is that it must be "clearly consistent with the National interest" to issue the clearance.

If a favorable determination cannot be made by the DISCO, the case is forwarded to the Office of the Assistant Secretary of Defense (Administration) for decision. DISCO does not have authority to deny or revoke clearance.

Emergency Suspension of Clearance. Authority is vested in the Defense Supply Agency Deputy Director for Contract Administration Services or, in his absence, to the Assistant Deputy Director to suspend an industrial personnel security clearance on an emergency basis. This action is taken only in those exceptional cases when information available indicates that retention of a security clearance constitutes an immediate threat to the national interest.

Emergency suspension actions are normally based on recommendations made by the DISCO or the cognizant security office. This information usually originates from contractor reports of loss, compromise, or suspected compromise. It may also result from a contractor's report concerning espionage, sabotage, or subversive activities at his facility.

From the foregoing description, the personnel security clearance process may appear to be a rather time consuming operation. Actually, the time required by DISCO to handle a favorable case is two days. The first is for reviewing the forms and requesting the necessary investigation. The second comes after completion of the investigation for review of the investigative results and issuance of the clearance. In these cases DISCO follows the "in today—out today" rule. In cases involving adverse or questionable information, the processing time increases on average to three days when a favorable decision can be

[1] *Additional copies of the ISM (DOD 5220.22-M) may be purchased for $2.25 prepaid from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.*

[2] *DOD Directive 5220.6 may be obtained without charge, one copy per request, from the Naval Publications and Forms Center, ATTN: Code 300, 5801 Tabor Ave., Philadelphia, Pa. 19120.*

made on available information. More time is consumed when investigations become involved.

Average elapsed times from receipt of requests until clearances are issued are 2 days for transfers, 12 days for conversions (a conversion involves former military or government civilian personnel when their government clearance is converted to an industrial security clearance), 22 days for new Secret clearance, and 65 days for new Top Secret clearances.

The DISCO screening job is made more complex by the omission of essential information on the Personnel Security Questionnaire (PSQ), (*e.g.*, name, complete address, signature, arrest record, mental disorders, etc.), and unacceptable fingerprint impression cards. The DISCO PSQ reject rate for 1969 was 15.5 percent on all clearance requests received. This rate would have been 31.5 percent had not DISCO made phone calls to resolve 16 percent of the cases.

Contractors can lessen deficiencies in requests for clearance forwarded to DISCO by ensuring that employees get clear instructions on completing the section of the questionnaire they accomplish in private and by thorough screening of the application to ensure there are no gaps in the individual's employment history or places of residence.

Benefits of accuracy and completeness in the initial submission of the request are self-evident. It speeds up the process of the clearance at DISCO. The sooner the employee receives clearance, the sooner he can become fully productive on the classified job.

Contractor-Granted Clearances. Contractors may grant security clearances to employees who require access to information classified no higher than the Confidential level. A contractor is not authorized to grant interim Confidential clearances. Also, contractor-granted Confidential clearances are not valid for access to restricted data, cryptographic information, communications analysis information, or NATO information, except NATO restricted data.

The contractor's determination for issuing a Confidential clearance is based on:

- Employment record of the employee.
- Information furnished by employee on DD Form 48–2, "Application and Authorization for Access to Confidential Information (Industrial)."
- Any other information known to the contractor which would indicate that the employee's access to classified information is not consistent with the national interest.

Complete information pertinent to contractor-granted clearances is contained in paragraph 24b of the Industrial Security Manual.

Standard Practice Procedure. Initial contacts established by the Industrial Security Representative with an industrial organization set the stage for more than just the clearance action. At this time interpretation and assistance is also given to company management on the requirements for safeguarding classified information contained in the Industrial Security Manual. These requirements involve such matters as security controls, visitor procedures, accountability of documents, security education, etc.

When a contractor receives a facility clearance, he must prepare a written Standard Practice Procedure (SPP). The SPP must contain sufficient detail to place into effect all security controls required by the Security Agreement (DD Form 441) and the Industrial Security Manual. Contents of the SPP will vary depending upon the type of facility and work to be performed. Each SPP must establish emergency procedures, "need-to-know" criteria, and personnel clearance requirements. The SPP will also cover, as applicable, controls for reproducing and handling of classified material, use of badges, storage procedures, visitor control, designation and access control to closed or restricted areas, overseas operations, etc.

When completed, a copy of the SPP must be submitted to the appropriate cognizant security office where it is reviewed for adequacy of conformance to the Security Agreement and the Industrial Security Manual. If inadequate, the contractor is advised of deficiencies so that modification can be made to meet necessary requirements.

Recurring Security Inspections. When a facility is cleared, it is then eligible for classified work. However, physical custody of classified documents or material requires the contractor to have physical safeguarding capability. This encompasses not only adequate, secure storage, but a combination of factors such as adequate procedures for handling the material and cleared personnel.

To assure that the contractor is adequately protecting classified information and to assist him where necessary, his facility is inspected periodically by a DCAS Industrial Security Representative from the congizant security office. It is during these recurring security inspections that a true determination can be made on how well vital defense information is being protected.

These inspections are more than just cursory "question and answer" sessions. Before he visits an industrial facility, the security representative reviews the contractor's Standard Practice Procedure and the results of previous inspections. At the contractor's plant, he certifies the degree of the facility and personnel clearances. He makes sure that the User Agency, which awarded the contract, furnished the contractor adequate classification guidance for aspects of the contract, *e.g.*, weapon characteristics. On the basis of the Industrial Security Manual, he checks the contractor's security education program; storage facilities; controls for restricted or closed areas; visitor controls; methods of transmitting, recording, reproducing, marking and disposing of classified material; controls exercised over subcontractors, consultants, meetings, and release of information to the public; and various other aspects of the security program.

One of the paramount considerations in the conduct of recurring security inspections is the "eyeball-to-eyeball" contact between the government representative and the contractor. In this environment, maximum opportunity is afforded for communication on all aspects of the Industrial Security Program. Employees, as well as management, have direct contact with a knowledgeable government security official. This enables them to see for themselves that security is a serious concern of their Government, with a resultant motivation factor that 5

might otherwise be difficult to instill. The opportunity for instruction is unlimited since both parties are directly involved in real life situations.

Other Aspects of Program

Loss, Compromise, or Suspected Compromise of Classified Information. No matter how hard we strive for effective security controls, there are occasions when classified information entrusted to contractors is exposed to loss, compromise, or suspected compromise. Each of these instances is thoroughly investigated by the contractor and a report is furnished to the cognizant security office. If the case appears to constitute a violation of Federal statutes, the cognizant security office refers it to an investigative agency of one of the military departments or to the Federal Bureau of Investigation.

When the situation warrants, immediate action is taken by the cognizant security office to ensure corrective action by the contractor. Depending on the situation, corrective action could involve the revising of the Standard Practice Procedure to expand or clarify necessary controls, special training for employees to stress the necessity for safeguarding classified information, issuing of reprimands, etc.

In addition, the cognizant security office notifies the government activities affected by the loss or compromise of classified information.

Termination of Clearances. Contractors may request administrative termination of personnel security clearances that are no longer required. Government-granted clearances and contractor-granted clearances can be administratively terminated for employees who have not had access to classified information for the preceding 18 months, and who will not require access in the foreseeable future.

This action is accomplished by executing DSA Form 683, "Request, for Administrative Termination of Personnel Security Clearance." The form is signed by the contractor security supervisor, a witness, and the employee, and certifies that clearance is no longer required. It also states that recommendation of termination is solely of an administrative nature and does not reflect adversely on the employee in any manner whatsoever.

In the case of government-granted clearances, the form is forwarded for processing directly to DISCO. In the termination of clearances granted to owners, officers, directors and executive personnel or contractor-granted clearances, the form is forwarded for processing to the appropriate cognizant security office since the original clearance for the OODEPs (on which a facility clearance is based) is processed by the cognizant office.

The objectives of the Defense Industrial Security Program are to deter and, if that fails, detect hostile espionage involving U.S. industry. It is next to impossible to prevent spying by foreign agents. Therefore, we attempt to deter access through the establishment of a system of personal integrity and physical security until, with passage of time or changes in events, classified information loses its significant value.

These objectives can be achieved through the mutual cooperation of Government and industry. The government's role is to conduct quality security inspections of contractor facilities and to provide an effective security education and training program and industry's role is to ensure that security is given top management support. Together Government and industry form a partnership which has resulted in a highly effective Defense Industrial Security Program.

Industrial Security Awards Announced

The 1970 winners of the James S. Cogswell awards for superior performance in carrying out security obligations on classified defense contracts have been announced by the Defense Supply Agency.

Approximately 13,000 industrial firms were considered for the awards.

Outstanding award plaques were presented to: ARO, Inc., Arnold AFS, Tullahoma, Tenn.; LTV Electrosystems, Inc., Greenville, S.C.; Stanford Research Institute, Huntsville, Ala.; Magnavox Co., Fort Wayne, Ind.; Battelle Memorial Institute, Columbus, Ohio; Tracor, Inc., Austin, Tex.; AVC, Inc., Albuquerque, N.M.; Texas Instruments, Inc., Dallas, Tex.; General Dynamics Corp., Fort Worth Division, Fort Worth, Tex.; Raytheon Co., White Sands Missile Range, N.M.; LTV Aerospace Corp., Sterling Heights, Mich.; Planning Research Corp., Los Angeles, Calif.; Gulf General Atomic, Inc., San Diego, Calif.; Aerojet-General Corp., El Monte, Calif.; Grumman Aerospace Corp., Bethpage, N.Y.; Hercules, Inc., Mineral Country, W.Va.; Applied Psychological Services, Inc., Wayne, Pa.; Pacific Telephone and Telegraph Co., San Francisco, Calif.; and Calvin Communications, Inc., Kansas City, Mo.

Certificates of excellence were awarded to: Singer-General Precision, Inc., Binghampton, N.Y.; Sylvania Electric Products, Inc., Needham Heights, Mass.; Adcom Division of Teledyne, Inc., Cambridge, Mass.; General Motors Corp., Oak Creek, Wis.; General Electric Co., Dayton, Ohio; EG&G, Inc., Albuquerque, N.M.; Western Co. of North America, Richardson, Tex.; Bendix Corp., Madison Heights, Mich.; CCI Aerospace Corp. (doing business as the Marquardt Co.), Van Nuys, Calif.; Litton Systems, Inc., Van Nuys, Calif.; Hudson Institute, Inc., Croton-on-Hudson, N.Y.; Maxson Electronics Corp., Great River, N.Y.; Martin Co., Middle River, Baltimore, Md.; Ordnance Research Laboratory, Pennsylvania State University, University Park, Pa.; United Aircraft Corp., Sunnyvale, Calif.; and Ball Brothers Research Corp., Boulder, Colo.

Factors in selecting the winners included:

- Degree of security consciousness evidenced by management personnel of industrial organizations.
- Security education and motivation program by contractors for employees.
- Regular inspections by contractors of security practices within the organization.
- Security review procedures in company publications and advertising.
- Adaption of new security methods in such areas as reproduction and transmission of documents, control of movement of employees and visitors within plants.

Small Business Share in Defense Contracts, RDT&E

Small business firms were awarded $5,492 million in defense prime contracts during FY 1970, $1,274 million less than during FY 1969. Of the total value of prime contracts awarded, $31,777 million, small business firms received 17.3 percent during FY 1970, compared with 17.8 percent in FY 1969.

Several factors contributed to the decrease in the small business share of defense procurement. Of prime significance was the decline of small business participation in ships, construction and services programs. Also impacting on the decrease was the loss of small firm participation due to growth, and acquisition or merger by large concerns.

Data on subcontract commitments to small business firms are obtained from large business firms which receive prime contract awards of $500,000 or more having substantial subcontracting possibilities. Reporting large business firms committed $11,931 million in subcontracts during FY 1970, of which $4,378 million, or 36.7 percent, went to small business firms. Subcontracts during FY 1969 were $14,883 million, of which $6,046 million, 40.6 percent, went to small business firms.

Defense prime contract awards for research, development, test and evaluation (RDT&E) work are included in Table 1 and are shown separately in Table 2. Small business firms were awarded $189 million in RDT&E prime contracts in FY 1970, $8 million less than in FY 1969. Small business firms received 4 percent of the RDT&E prime contracts awarded in FY 1970, compared with 3.7 percent in FY 1969.

Small Business Share of Defense Procurement

($000)

Type of Firm and Category of Procurement	Fiscal Year 1970 July 69–June 70	Fiscal Year 1969 July 68–June 69
Defense Procurement (Prime Contracts) From All Business Firms—Total	$31,177,076	$37,986,280
Missile and Space Systems	4,785,308	5,288,625
Aircraft	6,596,153	8,316,897
Other Major Hard Goods	9,122,517	11,671,965
Services	2,938,036	2,934,176
Commercial Items, Construction and All Purchases Under $10,0000	7,749,534	9,169,433
Civil Functions	585,628	655,184
Defense Procurement (Prime Contracts) From Small Business Firms—Total	5,491,727	6,765,375
Missile and Space Systems	86,788	94,211
Aircraft	175,608	242,603
Other Major Hard Goods	809,626	1,153,028
Services	580,409	658,294
Commercial Items, Construction and All Purchases Under $10,000	3,601,289	4,367,395
Civil Functions	288,067	249,847
Percentage of Defense Prime Contracts To Small Business Firms—Total	17.3%	17.8%
Missile and Space Systems	1.8	1.8
Aircraft	2.7	2.9
Other Major Hard Goods	8.9	9.9
Services	19.8	22.5
Commercial Items, Construction and All Purchases Under $10,000	46.5	47.6
Civil Functions	40.7	38.1
Subcontracts		
Number of Reports from Large Business Firms	934*	946
Subcontract Commitments by Reporting Large Business Firms	$11,930,568*	$14,883,450
Commitments to Small Business Firms	4,377,994*	6,046,444
Percent to Small Business	36.7	40.6

Table 1

*Preliminary, Subject to Revision.

Research, Development, Test and Evaluation

($000)

Type of Firm and Department	Fiscal Year 1970 July 69–June 70	Fiscal Year 1969 July 68–June 69
Total	$4,771,899	$5,320,090
Army	940,067	1,074,739
Navy	1,556,756	1,393,310
Air Force	2,275,076	2,852,041
Small Firms	189,110	197,583
Army	53,420	60,378
Navy	66,624	80,400
Air Force	70,066	56,801
Other Firms	4,582,789	5,122,507
Army	887,647	1,014,366
Navy	1,490,132	1,312,901
Air Force	1,205,010	2,795,240
Small Firms as a Percent of Total	4.0%	3.7%
Army	5.6	5.6
Navy	4.3	5.8
Air Force	3.1	2.0

Table 2

Note: Statistics contained in Tables 1 and 2 were compiled by the Directorate for Information Operations, Office of the Assistant Secretary of Defense (Comptroller), Washington, D.C. 20301.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Louis A. deRosa is now the Asst. to the Secretary of Defense (Telecommunications), the first appointee to the position. He will be principal staff assistant to the Secretary of Defense for telecommunications matters, and for the National Communications System. He will be responsible for development of DOD telecommunications policy, directives to support policy, and for recommending program/budget policies, plans and procedures as they relate to telecommunications.

Robert J. Pranger has been sworn in as Dep. Asst. Secretary of Defense (International Security Affairs) for Policy Plans and NSC Affairs. Replacing him as Dep. Asst. Secretary of Defense (ISA) for Near East and South Asian Affairs is James H. Noyes.

Maj. Gen. William E. Shedd III, USA, is the new Dep. Dir. of Operations and Administration, Defense Atomic Support Agency, Washington, D.C.

Rear Adm. Roderick O. Middleton, USN, has been designated Military Asst. to the Dep. Dir., Research and Engineering (Strategic and Space Systems), Office of the Secretary of Defense. Also within DDR&E, G. Ronald Wenninger is the new Asst. Dir. (Tactical Systems Plans and Analysis), and Dr. Howard L. Yudkin is now Asst. Dir. (Information and Communications).

Robert G. Gibson is the new Research and Engineering Consultant on the staff of the Commander in Chief, Pacific, with primary duty to provide technical information on new military systems and programs related to the Pacific Command.

In the Defense Supply Agency, new assignments include: Brig. Gen. Louis J. Schelter Jr., USA, Commander, Defense Contract Administration Services Region (DCASR), New York, N.Y.; Col. Forrest R. Dupont, USAF, Commander, DCASR, St. Louis, Mo.; Capt. John W. Lipscomb Jr., SC, USN, Commander, DCASR, Atlanta, Ga.; Col. Harold W. Yount, USA, Commander, DCASR, Dallas, Tex.; and Kenneth W. Eppert, Acting Chief of Contracts Compliance, Contract Administration Services, Hq., Defense Supply Agency, Cameron Station, Alexandria, Va.

DEPARTMENT OF THE ARMY

Lt. Gen. John Norton has been assigned as Asst. Chief of Staff for Force Development, Office of the Chief of Staff of the Army. Replacing Lt. Gen. Norton as Dep. Dir., Project MASSTER (Mobile Army Sensor Systems Test and Review), Fort Hood, Tex., is Maj. Gen. George P. Seneff Jr.

Maj. Gen. Charles T. Horner, Jr. has been named Chief of Staff, Army Materiel Command, Washington, D.C.

Col. George W. Connell is now Commander, Edgewood Arsenal, Md. His new Dep. Commander is Col. George A. Lynn.

Col. Wallace O. Enderle has taken command of the Army's Electronic Proving Ground, Fort Huachuca, Ariz.

The new commander of the Mobility Equipment and Research and Development Center, Fort Belvoir, Va., is Col. Bennett L. Lewis.

Col. Nelson W. Tobey is the new head of the Missile Test and Evaluation Directorate, White Sands Missile Range, N.M.

Col. Douglas G. Younger is now Commander, Army Institue of Special Studies, Combat Developments Command, Ft. Belvoir, Va.

New assignments in the Army Test and Evaluation Command, Aberdeen Proving Ground, Md., include: Col. Robert T. O'Brien, Dir., Electronics Materiel Testing; Col. John B. Hammond, Dir. of Logistics; Col. George T. Morris, head of the Test Systems Analysis Directorate; Lt. Col. Richard A. Humes, Dep. Dir., Electronics Materiel Testing; and Lt. Col. David B. King II, Dir., Aviation Materiel Testing.

In the Strategic Communications Command, Fort Huachuca, Ariz., new assignments include: Col. George W. Adair, Dep. Commander, Communications Electronics Engineering Installation Agency (CEEIA); Col. John H. Grady, Dir., Communications Engineering, CEEIA; and Col. George B. Jordan, Dir., Telecommunications Automation Directorate, CEEIA.

DEPARTMENT OF THE NAVY

New appointees in the Office of Chief of Naval Operations include: Rear Adm. Charles Becker, Dir., Materiel; Rear Adm. Donald D. Engen, Dir., Strategic Plans and Policy; Rear Adm. Kenneth L. Woodfin, Dir. Navy Space Program; Rear Adm. Roger E. Spreen, Dir., Navy Information Systems; and Capt. Robert Y. Kaufman, Undersea Long Range Missile System Coordinator.

In the Naval Materiel Command, new assignments include: Rear Adm. Edwin E. McMorries, Asst. Commander for Contracts, Naval Air Systems Command, Washington, D.C.; Rear Adm. Kenneth L. Woodfin, Dir. of Contracts, Naval Ship Systems Command, Washington, D.C.; Capt. Randolph W. King, Commander, Naval Ship Research and Development Center, Carderock, Md.; and Capt. W. A. Walls, CEC, Commander, Naval Civil Engineering Laboratory, Port Hueneme, Calif.

Recent assignments in Headquarters, U.S. Marine Corps, Washington, D.C., are: Brig. Gen. R. H. Spanjer, Dir., Systems Support Group; Brig. Gen. (selectee) James H. Berge Jr., Asst. Dep. Chief of Staff (Air); and Brig. Gen. (selectee) Wilbur F. Simlik, Dept. Asst. Chief of Staff, G–4.

Rear Adm. C. M. Hart, former Commander, Long Beach Naval Shipyard, Calif., is now Supervisor of

Shipbuilding Conversion and Repair, Newport News, Va. His replacement at Long Beach is Capt. Richard C. Fay.

New assignments in the Ship Parts Control Center, Mechanicsburg, Pa., include: Capt. William M. Oller, Executive Officer; and Capt. H. C. Sharp, Dir., Support Services Group.

DEPARTMENT OF THE AIR FORCE

Brig. Gen. Lew Allen, Jr. is now the Asst. to the Dir. of Special Projects, Office of the Secretary of the Air Force, located in Los Angeles, Calif.

Brig. Gen. John W. Baer has been designated Dep. Dir. of Operations for Strike Forces, Office of the Dep. Chief of Staff for Plans and Operations, Hq., USAF, Washington, D.C.

New assignments in Air Force Systems Command include: Col. George H. Chronis, Dir., Test Track Division, Air Force Missile Development Center, Holloman AFB, N.M.; Col. Lyle W. Cameron, Dir. of Systems Engineering, Office of the Dep. for Engineering, Aeronautical Systems Division, Wright-Patterson AFB, Ohio, Col. Harry L. Orthman, Asst. Dep. for FY-15/Joint Engine Programs Office, Aeronautical Systems Division, Wright-Patterson AFB, Ohio; and Col. John G. Paulisick, Dep. for Development Planning, Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

Within the Electronic Systems Division, AFSC, L. G. Hanscom Field, Bedford, Mass., assignments include: Col. Gonzalo Fernandez, Dep. Commander for Command and Management Systems; Col. Robert F. Jensen, Dir., Automatic Data Processing Equipment Selection Directorate; Col. Orville J. Kvamme, Dir., Air Weapons Surveillance and Control System Program Office; Col. Robert B. Stewart, Dir., Aerospace Instrumentation Program office; Col. Robert B. Stewart, Asst. Dep. for Airborne Warning and Control System (AWACS); and Lt. Col. George G. Deranian, Dir., Tactical Satellite Communications Program.

Col. Byron L. Schatzley has been named Commander, Aeronautical Chart and Information Center, St. Louis, Mo.

Selected Acquistion Costs Reported

Costs of 36 major defense weapon system acquisitions have grown $17,699 million to $102,331 million, according to the latest Selected Acquisitions Report to Congress. However, the June 30, 1970, report showed decreases in cost growth from reports made in March 1970, and in June 1969 for a slightly different set of acquisitions.

Total cost growth in the June report resulted from a number of changes:

- Engineering — 19 percent
- Support — 7 percent
- Schedule — 14 percent
- Unpredictable — 3 percent
- Economic — 11 percent
- Estimating — 42 percent
- Other — 4 percent

Changes in Cost Growth

($ millions)

	March 1970 to June 1970	June 1969 to June 1970
	$ 20,153	$ 20,109
	17,699	17,699
Change in Cost Growth	$—2,454	$—2,410
Reasons for Change		
Added or Cancelled Systems	65	1,258
Contract Approved, Development Estimate Adopted	—1,734	—3,769
Accounting Changes	—1,381	—1,131
Corrections	43	43
Economic Changes	276	356
Engineering, Support Changes	339	829
Other Changes	—62	4

Cost Estimates for Selected Acquisitions

($ millions)

System	Development estimate	Quantity Adjustment	Adjusted development estimate	Other cost growth	June 30, 1970 current estimate
Army					
SAM-D	$ 3,989	$−1,791	$ 2,198	$+1,216	$ 3,414
MBT-70	2,091	−602	1,489	+337	1,826
Cheyenne (R&D) only	126	—	126	+76	202
Lance	653	—	653	+108	761
Sheridan	376	−13	363	+93	456
Shillelagh	357	−18	339	+157	496
Safeguard					
Phase I only	4,185	+20	4,205	+389	4,594
Mod. Phase II	1,345	—	1,345	—	1,345
Total Army	$13,122	$−2,404	$10,718	$+2,376	$ 13,094
Navy					
A-7E	1,466	−385	1,081	+494	1,575
F-14	6,166	+2,036	8,202	+77	8,279
P-3C	1,294	+971	2,265	+286	2,551
S-3A	2,891	—	2,891	+43	2,934
Condor	441	−221	220	+131	351
Phoenix	677	+216	893	+608	1,501
Poseidon	4,569	−244	4,325	+790	5,115
Sparrow E	741	−460	281	+12	293
Sparrow F (Mod)	454	+114	568	+490	1,058
MK 48 (0/1/2)	714	+489	1,203	+2,554	3,757
SSN-688	1,658*	+2,376	4,034	+246	4,280
DD-963	2,581	+1,596	4,177	—	4,177
DLGN-38	769*	+3,211	3,980	+1,510	5,490
LHA	1,380	—	1,380	+48	1,428
CVAN 68	428*	—	428	+116	544
CVAN 69	519*	—	519	—	519
Total Navy	$26,748	$+9,699	$36,447	$+7,405	$43,852
Air Force					
F-111A/C/D/E/F	5,505	−2,581	2,924	+3,457	6,381
FB-111A	1,781	−1,043	738	+469	1,207
C-5A	3,413	−736	2,677	+1,632	4,309
A-7D	1,379	−282	1,097	+303	1,400
B-1	10,108	—	10,108	—	10,108
F-15	7,355	—	7,355	+1	7,356
AWACS	2,663	—	2,662	—	2,662
Maverick	384	−74	310	+34	344
Minuteman II	4,255	+4	4,259	+207	4,466
Minuteman III	4,674	−38	4,636	+999	5,635
SRAM	237	+118	355	+736	1,091
Sparrow E	529	−205	324	+36	360
Sparrow F	12	+10	22	+44	66
Total Air Force	$42,294	$−4,827	$37,467	$+7,918	$ 45,385
Totals					
Navy	26,748	+9,699	36,447	+7,405	43,852
Air Force	42,294	−4,827	37,467	+7,918	48,385
Army	13,122	−2,404	10,718	+2,376	13,094
Grand Totals	$82,164	$+2,468	$84,632	$ 17,699	$102,331

*Planning Estimate used—no Development Estimate available

U.S. Withdraws from Mallard

The Department of Defense has notified the governments of Australia, Canada, and the United Kingdom that the United States has decided to withdraw from the Mallard Project, a four-nation cooperative research and development program for tactical communications.

Dr. John S. Foster Jr., Director of Defense Research and Engineering, explained that although the Mallard had been an extremely productive development whose international character enhanced its ideas and productivity, DOD had not been able to win Congressional support for continued U.S. participation in the program.

The Mallard Project has been a cooperative venture among the four partner nations to share the cost of the research and development of an advanced tactical communication system which would provide the same equipment and standards for the armies and air forces of those nations.

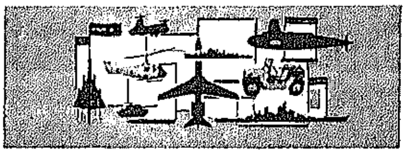
The project began officially in April 1967, and had progressed to the point where pre-prototype models of system components were being constructed to test the feasibility of the selected system design. The joint schedule called for introduction of Mallard standard equipment into the operating forces of the participating nations in 1978.

The United States had spent $34 million in the cooperative program and $15 million in unilateral support efforts.

This effort has resulted in a number of products needed in the design of follow-on systems, including a set of detailed design standards for tactical communications and a detailed design for an all digital system.

Dr. Foster indicated to the Mallard partners that the United States plans to conduct an extensive review of its particular requirements for tactical communications during the next year, and would continue to work for compatability of tactical communications with its former Mallard partners and major NATO nations.

Dr. Foster's remarks were contained in letters addressed to the Chiefs of the Defense Missions in Washington of the three Mallard partners.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of September 1970.

DEFENSE SUPPLY AGENCY

8—Hess Oil and Chemical Corp., Woodbridge, N.J., $1,424,228. Fuel oil and gasoline for delivery to Delaware, Washington, D.C., Indiana, Kentucky, Maryland, Ohio, Tennessee, Virginia, and West Virginia. Defense Fuel Supply Center, Alexandria, Va. DSA 600-70-D-2099.

9—*Tennessee Overall Co., Inc., Tullahoma, Tenn. $1,210,302. 389,165 pairs of men's khaki cotton twill trousers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-71-C-0277.

11—Jervis B. Webb Co. of Calif., Washington, D.C. $1,096,447. A mechanized material handling system. South Gate, Calif. Defense Construction Supply Center, Columbus, Ohio. DSA 700-71-C-1269.

17—The Defense Personnel Support Center, Philadelphia, Pa., issued the following contracts:

*Marcie Dale, Inc., Atlantic City, N.J. $1,148,264. 78,120 men's green wool serge coats, with belts, for the Marine Corps. DSA 100-71-C-0294.

*Supreme Manufacturing Co., Dallas, N.C. $1,008,169. 2,000,000 men's white cotton crew neck undershirts. Dallas and Clover, S.C. DSA 100-71-C-0316.

29—*Delta Petroleum Co., Inc., New Orleans, La. $1,181,214. 2,712,375 gallons of lubricating oils. Defense Fuel Supply Center, Alexandria, Va. DSA 600-71-C-0668 P00001.

30—The Defense Fuel Supply Center, Alexandria, Va., issued the following contracts for fuel oil and gasoline:

Standard Oil Co. of Calif., San Francisco, Calif. $1,457,057. DSA 600-71-D-0499.

Armour Oil Co., San Diego, Calif. $2,326,623. DSA 600-71-D-0465.

Mobil Oil Corp., New York, N.Y. $3,068,-978. DSA 600-71-D-0485.

Powerine Oil Co., Santa Fe Springs, Calif. $1,088,382. DSA 600-71-D-0490.

Shell Oil Co., New York, N.Y. $3,936,312. DSA 600-71-D-0490.

> **CONTRACT LEGEND**
>
> Contract information is listed in the following sequence: Date—*Small Business Firm—Company—Value—Material or Work to be Performed—Location of Work Performed (if other than company plant)—Contracting Agency—Contract Number.

DEPARTMENT OF THE ARMY

1—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications for metal bomb fuze parts:

Eureka Williams Co., Bloomington, Ill. $1,113,710. 169,000 parts. DA-AA09-70-C-0329.

Batesville Manufacturing Co., Batesville, Ark. $1,115,400. 169,000 parts. DA-AA09-70-C-0370.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contracts for 750-lb bomb metal parts:

R. G. LeTourneau, Inc., Longview, Tex. $11,068,680. 132,000 parts. DA-AA09-71-C-0010.

AMF, Inc., New York, N.Y. $6,906,960. 72,000 parts. DA-AA09-71-C-0011.

—Raytheon Co., Andover Mass. $2,816,000 (contract modification). Engineering services for the Improved Hawk missile. Andover and Bedford, Mass., and White Sands Missile Range, N.M. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0195.

—White Motor Corp., Lansing, Mich. $1,-874,724. Engineering services for the M39 5-ton 6x6 truck. Chicago, Ill. Army Tank Automotive Command, Warren, Mich. DA-AE07-71-C-0027.

—Motorola, Inc., Scottsdale, Ariz. $2,781,-384. Design, fabrication, testing and delivery of one Long Range Positioning Determining System (LRPDS). Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. DA-AK02-71-C-0022.

2—Cooper Bessemer Co., Mt. Vernon, Ohio. $4,328,768. Diesel engine generators for the Malmstrom ABM Safeguard site. Mt. Vernon and Grove City, Pa. Army Engineer District, Huntsville, Ala. DA-CA87-69-C-0008.

—Raytheon Co., Andover, Mass. $1,171,769. Technical publications on the Improved Hawk missile system. Army Missile Command, Huntsville, Ala. DA-AH01-71-C-0120.

—The following contracts were issued by the Army Electronics Command, Fort Monmouth, N.J.:

IBM, Inc., Owego, N.Y. $1,500,000. Classified electronics equipment.

ITT Gilfillan, Van Nuys, Calif. $2,500,-000. Five Raytac radar systems. DA-AB07-70-C-0176.

3—Varo, Inc., Garland, Tex. $1,523,843. Receiving and transmitting sets. Army Electronics Command, Fort Monmouth, N.J. DA-AB05-71-C-3705.

4—DeLaval Turbine, Inc., Oakland, Calif. $1,885,676. Five 1,750 kw diesel generators. Cheyenne Mountain Complex, Colorado Springs, Colo. Army Engineer District, Omaha, Neb. DA-CA45-71-C-0027.

8—Control Data Corp., Honolulu, Hawaii. $1,688,874. Systems development and modification to MACV civil operations rural development support. Republic of Vietnam. Army Missile Command, Huntsville, Ala. DA-AH01-71-C-0009.

—Tasker Industries, Saugus, Calif. $1,[illegible]-160. 373,600 60mm illuminating projectiles, M83A3. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-71-C-0017.

—AVCO Corp., Charleston, S.C. $1,764,[illegible]. Overhaul and modification of 252 T53-L-13A turbine engines. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-A-0308.

10—Sperry Rand Corp., St. Paul, Minn. $1,-402,789. Computer time and services for the Safeguard System Evaluation Agency. White Sands Missile Range, N.M. Safeguard Systems Command, Huntsville, Ala. DA-HC60-71-C-0021.

—Hughes Aircraft Co., Culver City, Calif. $2,150,629. TOW engineering services for 12 months. Army Missile Command, Huntsville, Ala. DA-AH01-71-C-0122.

11—Northrop Corp., Anaheim, Calif. $2,2[illegible]-330. 122,000 Fleshett warheads. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-71-C-0022.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., issued the following contract modifications for metal parts for the M374A1 HE projectile:

Chamberlain Manufacturing Corp., Elmhurst, Ill. $2,386,400. Burlington Army Ammunition Plant, Burlington, N.J. DA-AA09-70-C-0208.

Norris Industries, Inc., Los Angeles, Calif. $2,405,400. Army Ammunition Plant, Riverbank, Calif. DA-AA09-70-C-0207.

—McDonnell Douglas Astronautics Co., Titusville, Fla. $3,040,200. Services, engineering and development of the Dragon maintenance set for the Marine Corps. Army Missile Command, Huntsville, Ala. DA-AH01-71-C-0093.

—Consolidated Diesel Electric Co., Old Greenwich, Conn. $63,428,035. 6,201 1¼-ton 6x6 cargo trucks and ambulance trucks. Army Missile Facility, Charlotte, N.C., and Schenectady, N.Y. Army Tank Automotive Command, Warren, Mich. DA-AE07-63-C-2606.

—General Motors Corp., Detroit, Mich. $17,-782,142. 6,201 diesel engines for the M[illegible] truck. Army Tank Automotive Command, Warren, Mich. DA-AE07-68-C-2597.

14—The Army Electronics Command, Fort Monmouth, N.J., awarded the following contracts:

AVCO Corp., Cincinnati, Ohio. $1,5[illegible]-025. 14 remote control matched channel HF receivers and ancillary items. DA-AB07-71-C-0036.

Page Communications Engineers Inc., Washington, D.C. $3,077,607. Classified electronic equipment.

15—Sylvania Electric Products, Inc., Buffalo, N.Y. $4,077,265. 655 VHF/FM radio sets, AN/ARC-114, and 474 radio sets, AN/ARC-115. Army Electronics Command, Fort Monmouth, N.J. DA-AB07-71-C-[illegible].

16—The Army Missile Command, Huntsville, Ala., awarded the following contracts:

Applied Devices Corp., College Point, N.Y. $1,460,640. Modification kits for Hawk simulators, AN/TPQ-29. DA-AH01-70-C-0070.

Aerojet Solid Propulsion Co., Sacramento, Calif. $2,287,010. Loading Improved Hawk missile motors. Nimbus, Calif. DA-AH01-71-C-0071.

—*J. J. Cook Construction, Inc., Oklahoma City, Okla. $1,271,278. Construction of a Data Processing Plant addition, Tinker AFB, Okla. Army Engineer District, Fort Worth, Tex. DA-CA63-71-C-0039.

—Algernon Blair, Inc., Montgomery, Ala. $8,782,653. Construction of an enlisted men's barracks complex, and central heating and cooling plant, Fort Jackson, S.C. Army Engineer District, Savannah, Ga. DA-CA21-71-C-0019.

18—**AVCO Corp.**, Stratford, Conn. $3,460,000. Modification kits for T-53 gas turbine engines. Charleston, S.C., and Stratford. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-A-0334.

—***G. A. Goodwin Building Contractor, Inc.**, Boulder, Colo. $1,106,700. Construction of 48- and 52-man officers' quarters buildings, Lowry AFB, Colo. Army Engineer District, Omaha, Neb. DA-CA45-71-C-0033.

—***Phoenix General Construction Co., Inc.**, Dallas, Tex. $1,353,276. Construction of an addition to a hypersonic test facility, Arnold Engineering Development Center, Tullahoma, Tenn. Army Engineer District, Mobile, Ala. DA-CA01-71-C-0025.

—**Kentron Hawaii, Ltd.**, Honolulu, Hawaii. $10,981,356 (contract modification). Operation, maintenance and development of Kwajalein Missile Range Technical Facilities for 12 months. Kwajalein, Honolulu, and Huntsville, Ala. Army Safeguard System Command, Huntsville, Ala. DA-HC60-69-C-0003.

—**General Motors Corp.**, Detroit, Mich. $1,264,349. Diesel engines for fork lift trucks. Army Mobility Equipment Command, St. Louis, Mo. DA-AK01-71-C-1578.

22—***Fred A. Arnold, Inc.**, Los Angeles, Calif. $1,785,683. Construction of a 160-man officers' quarters building, Mather AFB, Calif. Army Engineer District, Sacramento, Calif. DA-CA05-71-C-0032.

24—**Pace Co.**, Memphis, Tenn. $3,208,819 (contract modification). White star ground parachute signals, M127A. Memphis and Camden, Ark. Picatinny Arsenal, Dover, N.J. DA-AA21-70-C-0381.

—***NACCO**, San Antonio, Tex. $2,070,868. Construction of a two-story addition to a training facility, and a three-story dormitory, Lackland AFB, Tex. Army Engineer District, Fort Worth, Tex. DA-CA63-71-C-0043.

25—**Bowen-McLaughlin-York Co.**, York, Pa. $2,612,550 (contract modification) 24 M107 175mm self-propelled guns and 18 M578 tank recovery vehicles. Army Weapons Command, Rock Island Arsenal, Ill. DA-AF03-70-C-0044.

—***Prime Construction Co., Inc.**, Seattle, Wash. $1,248,470. Construction of a 1,000 man Army Reserve Center with a 5 bay maintenance shop, Fort Lawton, Seattle, Wash. Army Engineer District, Sacramento, Calif. DA-CA05-71-C-0033.

—***Carney General Contractor, Inc.**, Highland Park, Ill., and ***Metropolitan Construction Co.**, Kansas City, Mo. (joint venture). $1,661,917. Construction of recreational facilities, Rend Lake, Franklin County, Ill. Army Engineer District, St. Louis, Mo. DA-CW43-71-C-0034.

—**National Presto Industries, Inc.**, Eau Claire, Wis. $16,996,566 (contract modification). Metal parts for 105mm high explosive projectiles, M1. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0028.

28—**Computer Sciences Corp.**, Los Angeles, Calif. $1,176,428. Automatic data processing services for the Logistics ADP system in Vietnam and Thailand. Assistant Chief of Staff, G-4, USA, Hawaii. DA-GA01-70-C-0607.

30—**Martin Marietta Corp.**, Orlando, Fla. $2,789,956. Modification kit installation and modified equipment training for the Pershing missile system. DA-AH01-71-C-0185. $10,274,557. Industrial engineering services for the Pershing missile system. DA-AH01-71-C-0127. Army Missile Command, Huntsville, Ala.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., awarded the following contracts:

Stewart Warner Corp., Indianapolis, Ind. $1,990,900. Metal parts for M148 adapter boosters. DA-AA09-71-C-0060.

Sperry Rand Corp., New York, N.Y. $3,756,202 (contract modification). Loading, assembling and packing 155mm projectiles, demolition charges and 57mm smoke cartridges. Army Ammunition Plant, Shreveport, La. DA-11-173-AMC-0080(A).

Thiokol Chemical Corp., Bristol, Pa. $1,637,434 (contract modification). Loading, assembling and packing 40mm and 81mm cartridges, and M125A1 signals. Longhorn Army Ammunition Plant, Marshall, Tex. DA-11-173-AMC-00200 (A).

Uniroyal, Inc., New York, N.Y. $2,827,852 (contract modification). Operation and maintenance of government owned TNT manufacturing facility, Army Ammunition Plant, Joliet, Ill. DA-11-173-AMC-00062(A).

Hercules, Inc., Wilmington, Del. $6,513,328 (contract modification). Operation and maintenance of government owned propellant production facility, Army Ammunition Plant, Radford, Va. DA-11-173-AMC-00037(A).

—The Army Engineer District, Fort Worth, Tex., awarded the following contracts:

C. H. Leavell and Co., El Paso, Tex. $7,933,470. Construction of two recruit training and housing facility buildings, Lackland AFB, Tex. DA-CA63-71-C-0053.

***Herman Smith and Co.**, Fort Worth, Tex. $3,016,000. Construction of a three-story masonry dormitory, with single story administration area, and adjoining dining hall and kitchen, Shepperd AFB, Tex. DA-CA63-71-C-0054.

***Beckman Construction Co.**, Fort Worth, Tex. $1,799,121. Masonry constructed chapel, gymnasium, brigade headquarters, branch exchange and dispensary, Fort Hood, Tex. DA-CA63-71-C-0055.

—**Norris Industries, Inc.**, Los Angeles, Calif. $5,107,200. 2.75 inch rocket tubes. Picatinny Arsenal, Dover, N.J. DA-AA21-71-C-0142.

—**TRW, Inc.**, Redondo Beach, Calif. $5,000,000. Classified electronics research and development. Army Electronics Command, Fort Monmouth, N.J.

—**Uniroyal, Inc.**, Detroit, Mich. $1,193,639. Pneumatic tires for 2½ and 5 ton trucks. Army Tank Automotive Command, Warren, Mich. DA-AE07-71-C-1461.

—**General Motors Corp.**, Indianapolis, Ind. $3,489,074 (contract modification). Production and engineering services for the M551 Sheridan vehicle. Cleveland, Ohio. Army Weapons Command, Rock Island, Ill. DA-33-019-AMC-00248(W).

—**American Dredging Co.**, Philadelphia, Pa. $1,027,593. Channel dredging on the Arkansas River, LeFlore and Sequoyah Counties, Okla. Army Engineer District, Tulsa, Okla. DA-CW56-71-C-0036.

—***Will Construction Co., Inc.**, Seattle, Wash. $4,083,000. Modification and height extension of 20 spillway gates, and 10 new hoists for remote control operation. Bonneville Dam, Multnomah County, Ore. Army Engineer District, Portland, Ore. DA-CW57-71-C-0030.

—**Western Electric Co.**, New York, N.Y. $7,560,000 (contract modification). Kwajalein Missile Range measurements and radar data collection. Bell Telephone Labs, Whippany, N.J.; RCA, Moorestown, N.J.; WE Co.; and other subcontractors. DA-HC60-69-C-0001. $1,995,000 (contract modification). Advanced ballistic missile defense studies in systems and technology. Bell Telephone Labs, Whippany, N.J.; Cornell Aeronautical Labs, Buffalo, N.Y.; WE Co.; and other subcontractors. DA-HC60-69-C-0008. $205,300,831 (contract modification). Production requirements for the approved Phase I program for 90 days. WE Co., New York, N.Y., Allentown, Pa., Burlington, Winston-Salem and Greensboro, N.C.; Bell Telephone Labs, Whippany, N.J.; GE Co., Syracuse, N.Y., and Huntsville, Ala.; Raytheon Co., Bedford, Mass.; McDonnell Douglas Corp., Santa Monica, Calif.; Martin Marietta Corp., Orlando, Fla.; Motorola, Inc., Phoenix, Ariz.; Texas Instruments, Dallas, Tex.; and other subcontractors. DA-HC60-68-C-0017. Safeguard System Command, Huntsville, Ala.

DEPARTMENT OF THE NAVY

1—**Meredith Construction Co., Inc.**, Norfolk, Va. $1,260,898. 48 family housing units, Armed Forces Staff College, Norfolk, Va. Atlantic Division, Naval Facilities Engineering Command, Norfolk, Va. N62470-70-C-0819.

—**Atlantic Research Corp.**, Costa Mesa, Calif. $2,888,217. 48 Mk 35 target boats. Naval Ship Systems Command, Washington, D.C. N00024-71-C-0231.

2—**Westinghouse Electric Corp.**, Mifflin Borough, Pa. $29,796,728. Nuclear propulsion research and development. Naval Ship Systems Command, Washington, D.C. N00024-70-C-5028.

3—**Interstate Electronics Corp.**, Anaheim, Calif. $8,571,000. Test instrumentation for the Poseidon fleet ballistic missile. Naval Strategic Systems Project Office, Washington, D.C. N00030-69-C-0209.

—**United Aircraft Corp.**, East Hartford, Conn. $4,004,963. Development of the TF-30-P412 engine for the F-14 aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0393.

—**Applied Physics Laboratory, Johns Hopkins University**, Silver Spring, Md. $1,132,275. Increased level of effort for research and development studies. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604.

—**Franchi Brothers Construction Corp.**, Auburndale, Mass. $2,186,000. Construction of a professional education center, Naval War College, Newport, R.I. Naval Facilities Engineering Command, Washington, D.C. N62464-69-C-0191.

—**General Dynamics Corp.**, Groton, Conn. $2,999,400. Nuclear-powered attack submarine concept formulation studies. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0308.

—**Bendix Corp.**, Teterboro, N.J. $3,750,000. Automatic flight control system components for A-4 and TA-4F aircraft. Teterboro and Hollywood, Calif. Naval Aviation Supply Office, Philadelphia, Pa. N00383-69-A-0004-0393.

4—**Yakish Builders, Inc., and Construcciones Werl, Inc.** (joint venture), Atlanta, Ga. $2,913,044. Construction of quarters, Naval Station, Roosevelt Roads, P.R. N62470-70-C-1195.

—**LTV Aerospace Corp.**, Dallas, Texas. $1,000,000. Increase limitation of government liability for A-7E avionics/VAST program sets, program design and assurance plan. Naval Air Systems Command, Washington, D.C. N00019-69-C-0536.

8—**General Dynamics Corp.**, Groton, Conn. $8,750,000 (contract modification). Engineering and design services to support non-nuclear alterations and related work for USS Benjamin Franklin (SSBN-640) class submarines. Naval Ship Systems Command, Washington, D.C. N00024-69-C-0271 PZ0005.

—**Sperry Rand Corp.**, St. Paul, Minn. $1,509,340. 12 keyset control computers, peripheral equipment, data and engineering services for the Naval Tactical Data System (NTDS). Naval Ship Systems Command, Washington, D.C. N00024-71-C-1029.

9—**Lockheed Missiles and Space Co.**, Sunnyvale, Calif. $1,928,605. Advanced Poseidon missile system engineering and preliminary engineering studies for the Undersea Long Range Missile System. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-C-0081.

—**Sperry Systems Management Division, Sperry Rand Corp.**, Syosset, N.Y. $10,812,000. 71,600 man-days technical assistance for the Polaris/Poseidon inertial navigation program. Naval Ship Systems Command, Washington, D.C. N00024-71-C-5059.

10—**North American Rockwell Corp.**, Columbus, Ohio. $1,200,000. Long lead time items in support of OV-10C aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0696.

—United Aircraft Corp., East Hartford, Conn. $17,619,190. J-52-P-408, J-52-P-8B and TF30-P-412 engines. Naval Air Systems Command, Washington, D.C. N00019-70-C-0208.

11—Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $638,400,000 (contract modification). Construction of USS Nimitz (CVAN 68) and USS Dwight D. Eisenhower (CVAN 69). Naval Ship Systems Command, Washington, D.C. N00024-67-C-0325 PZ0041.

14—Walsh and Co., Anchorage, Alaska. $3,649,206. 100 family housing units, Naval Station, Adak, Alaska. Naval Facilities Engineering Command, Washington, D.C. N62476-70-C-0038.

—Westinghouse Electric Corp., Baltimore, Md. $1,817,000. Continuing development support for the design, development, test and evaluation of proposed modification to the Mk 48 torpedo. Lansdowne, Md. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1216.

15—Westinghouse Electric Corp., Washington, D.C. $1,500,000. FY 1971 funding increment for design and development of launching and handling equipment for Poseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030-66-C-0199.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

The Boeing Co., Philadelphia, Pa. $1,524,000. Services and materials for progressive aircraft rework on CH-46F helicopters. N00019-71-C-0086.

General Time Corp., Skokie, Ill. $1,505,336. Mk 339 Mod 0 mechanical time fuzes, plus shipping and storage containers. N00019-70-C-0141.

Sparton Corp., Jackson, Mich. $1,599,191. AN/SSQ-47B sonobuoys and refurbishing kits. DeLeon Springs, Fla. N00019-70-C-0466.

16—Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $2,428,690 (contract modification). Planning, scheduling and design work for the nuclear-powered guided missile frigate, DLGN-38. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0252 P00002.

17—Corbin Construction Co., Inc., Dunn, N.C. $1,771,147. Construction of a water treatment plant, wells and distribution system, Camp Lejeune Marine Corps Base, N.C. Naval Facilities Engineering Command, Washington, D.C. N62470-70-C-0939.

—The Naval Air Systems Command, Washington, D.C., awarded the following contracts:

Raytheon Co., Bedford, Mass. $3,969,971. Guidance and control sections for Sparrow III missiles. Lowell and Bedford, Mass., Bristol, Tenn., and Oxnard, Calif. N00019-71-C-0024.

Grumman Aerospace Corp., Bethpage, N.Y. $14,000,000. Modification of E-2A aircraft to E-2A/APS-111 configuration. N00019-68-C-0542.

18—Interstate Electronics Corp., Anaheim, Calif. $4,760,000. Field engineering services in support of fleet ballistic missile test instrumentation. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-D-0065.

—Grumman Aeropsace Corp., Bethpage, N.Y. $4,000,000. Long lead-time items for the EA-6B aircraft. Naval Air Systems Command, Washington, D.C. N00019-70-C-0458.

—North American Rockwell Corp., Columbus, Ohio. $1,539,243. Services and materials to modify existing OV-10 aircraft to YOV-10D night observation gunship (NOGS) configuration. Navy Regional Procurement Office, Los Angeles, Calif. N00123-70-C-2027.

—Johns Hopkins University, Silver Spring, Md. $1,443,100. Increase the level of effort for research and development studies. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604.

21—Honeywell, Inc., Minneapolis, Minn. $13,393,991. Rockeye II weapon systems. Naval Air Systems Command, Washington, D.C. N00019-70-C-0140.

—Kaman Corp., Bloomfield, Conn. $2,185,215. H-2 aircraft main rotary blades. Bloomfield and Moosup, Conn. Naval Aviation Supply Office, Philadelphia, Pa. N00383-70-A-0101-0097.

22—Ryan Aeronautical Co., San Diego, Calif. $4,141,500. BQM-34E aerial targets for the Navy and Air Force. Naval Air Systems Command, Washington, D.C. N00019-69-C-0693.

—Raytheon Co., South Lowell, Mass. $3,592,187. Guidance and control sections for Sidewinder missiles. Naval Air Systems Command, Washington, D.C. N00019-70-C-0269.

—FMC Corp., San Jose, Calif. $21,828,530. 262 assault amphibious landing craft (LVTP-7). Naval Ship Systems Command, Washington, D.C. N00024-70-C-0281 P00003.

23—United Aircraft Corp., East Hartford, Conn. $23,363,040. TF30-P-100 engines for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-70-C-0208.

—Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $9,326,000. Long lead-time materials for the nuclear submarine SSN-688. Naval Ship Systems Command, Washington, D.C. N00024-70-C-0269 P00009.

24—Interstate Electronics Corp., Anaheim, Calif. $4,999,990 (contract modification). Test instrumentation for Poiseidon missiles. Naval Strategic Systems Project Office, Washington, D.C. N00030-70-C-0084.

25—Shafer and Miller, Inc., South Miami, Fla. $3,056,000. Construction of an Environmental Science Services Administration Atlantic, Oceanographic Laboratory, Virginia Key, Fla. Naval Facilities Engineering Command, Washington, D.C. N62467-68-C-0031.

28—Western Electric Co., New York, N.Y. $19,524,841. Oceanographic research. Bell Telephone Laboratories, Whippany, N.J. Naval Electronic Systems Command, Washington, D.C. N00039-71-C-0307.

29—The Naval Facilities Engineering Command, Washington, D.C., issued the following contracts:

Dawson Construction Co., Inc., Gadsden, Ala. $1,225,973. Construction of an academic building addition, NAS, Pensacola, Fla. N62467-67-C-0597.

G. L. Cory, Inc., San Diego, Calif. $12,619,133. Construction of an aircraft accessories overhaul shop, NAS, North Island, Calif. N62474-71-C-4025.

—Westinghouse Electric Corp., Baltimore, Md. $4,503,000. Increase the scope of work on the Mk 48 Mod O fire control interface with production prototype torpedo hardware. Lansdowne, Md. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1212.

—The Naval Air Systems Command, Washington, D.C., issued the following contracts:

Lockheed Aircraft Corp., Ontario, Calif. $1,943,012. Rework and modification of EC-121 aircraft. N00019-71-C-0120.

Grumman Aerospace Corp., Bethpage, N.Y. $1,500,000. Building maintenance at the Naval Weapons Industrial Reserve Plant, Bethpage. N00019-70-C-0023.

—Automated Terminal Services, Inc., Jamaica, N.Y. $2,616,000. Operation of Quick-Trans airfreight terminals. Navy Purchasing Office, Washington, D.C. N00600-71-C-0259.

30—Johns Hopkins University, Silver Spring, Md. $10,218,950 (contract modifications). Research and development studies. Naval Ordnance Systems Command, Washington, D.C. N00017-62-C-0604 Mods P101 and P102.

—General Electric Co., Phoenix, Ariz. $1,419,826. GE-635 electronic data processing system for the U.S. Naval Academy. Naval Automatic Data Processing Equipment Selection Office, Washington, D.C. N66032-71-C-0006.

—General Electric Co., Washington, D.C. $10,489,703. Operational engineering support services for fire control and guidance support equipment for Polaris and Poseidon fleet ballistic missiles. Pittsfield, Mass. Naval Strategic Systems Project Office, Washington, D.C. N00030-71-C-0106.

—North American Rockwell Corp., Columbus, Ohio. $17,661,600. T-2C aircraft. Naval Air Systems Command, Washington, D.C. N00019-70-C-0144.

DEPARTMENT OF THE AIR FORCE

1—Lockheed Aircraft Corp., Marietta, Ga. $7,017,462. C-5A spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657)-15053.

—AiResearch Manufacturing Co., Phoenix, Ariz. $2,031,202. Gas turbine engines and related technical data. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608-70-D-1401.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

The Boeing Co., Seattle, Wash. $5,500,000. Research and development of a short range attack missile (SRAMO). AF33(657)-16584.

Admiral Systems Corp., Chicago, Ill. $1,551,340. Electronic airborne test equipment for various aircraft communications system. F33657-71-C-0175.

2—ITT Technical Services, Inc., Paramus, N.J. $1,044,910. Operation and maintenance of AF Plant 42, Palmdale, Calif. Air Force Flight Test Center, Edwards AFB, Calif. F04611-71-C-0002.

—LTV Electrosystems, Inc., Greenville, Tex. $1,494,372. Supplies and services for repair and modification of F-101 aircraft subsystems. Greenville, S.C. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F41608-70-A-4015.

3—Fairchild Camera and Instrument Corp., Long Island, N.Y. $3,356,983. Aerial strike cameras and related components. Syosset, N.Y. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1318.

4—Texas Instruments, Inc., Austin, Texas. $3,285,778. Aircraft instrument landing systems, spare parts and related ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-71-C-0103.

8—General Electric Co., Cincinnati, Ohio, $2,927,600. J-79 engines, spare parts and aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-69-C-1285.

—Lockheed Aircraft Corp., Marietta, Ga. $5,023,847. C-5A aircraft spare parts. Detachment 31, Sacramento Air Materiel Area, AFLC, Marietta, Ga. AF33(657)-15053.

9—North American Rockwell Corp., Anaheim, Calif. $4,656,920. Maintenance and repair of Minuteman III guidance and control equipment. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0173.

10—Lloyd Wood Construction Co., Inc., Tuscaloosa, Ala. $5,196,112. 300 family housing units, Eglin AFB, Fla. F08651-71-C-0098.

11—Sierra Research Corp., Buffalo, N.Y. $2,879,850. Aerospace ground equipment applicable to airborne navigational aids. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F3657-69-C-70396.

—General Electric Co., West Lynn, Mass. $1,200,000. Improvement of aircraft engine components. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0545.

—North American Rockwell Corp., Anaheim, Calif. $20,750,000. Retrofit kits to update the Minuteman III weapon system. Space

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and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-71-C-0007.

—**Motorola Inc.**, Scottsdale, Ariz. $7,086,400. Munition proximity fuzes. Armament Development and Test Center, Eglin AFB, Fla. F08635-71-C-0017.

14—**Hughes Aircraft Co.**, Culver City, Calif. $2,900,000. Engineering services to design and develop a digital automatic flight control system for the F-106 aircraft. San Antonio Air Materiel Area, AFLC, Kelly AFB, Texas. F04606-70-A-0126.

—**The Boeing Co.**, Seattle, Wash. $5,500,000. Design, development, integrated test operations and evaluations for Minuteman missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0137.

15—**ITT Research Institute**, Chicago, Ill. $4,880,575. Operation of electromagnetic compatibility analysis center, Annapolis, Md. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628-70-C-0201.

—**Jet Electronics and Technology, Inc.**, Grand Rapids, Mich. $1,131,600. Attitude indicators for the F-4 and RF-4 aircrafts. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-71-C-0274.

16—The Ogden Air Materiel Area, AFLC, Hill AFB, Utah, issued the following contracts:

***Dell Industries**, Waycross, Ga. $1,058,-840. Air munitions. F42600-71-C-1131.

Honeywell, Inc., Hopkins, Minn. $1,640,-625. Air munition components. St. Louis Park, Minn. F42600-71-C-1163.

Gibbs Die Casting Aluminum Corp., Henderson, Ky. $1,402,700. Component parts for air munitions. F42600-71-C-1162.

17—**Analytical Services, Inc.**, Falls Church, Va. $1,136,148. Analytical studies on the application of a weapon system. Office of Scientific Research, AFSC, Arlington, Va. F44620-69-C-0014.

21—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Dynamics Corp., Fort Worth, Tex. $142,814,000. F-111 aircraft, spare parts, ground equipment, data and engineering services. F33657-70-C-1130.

General Electric Co., West Lynn, Mass. $1,223,334. Turbojet engines and related spare parts. F33657-70-C-0229.

—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., awarded the following contracts:

AVCO Corp., Wilmington, Mass. $1,120,-000. Design and flight testing of reentry vehicles in support of the anti-ballistic missile defense program. F04701-68-C-0278.

Philco-Ford Co., Palo Alto, Calif. $2,-275,125. Electronic equipment. F04701-70-C-0253.

22—**Philco-Ford Corp.**, Newport Beach, Calif. $29,862,000. Guidance and control units for air intercept missiles. Anaheim, Calif., and Philadelphia, Pa. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-71-C-0167.

23—**Sylvania Electronic Systems**, Needham Heights, Mass. $1,471,040 (contract modification). Portable radio spare parts. Directorate of Materiel Management, Kelly AFB, Tex. F33657-70-C-0495.

—**Philco-Ford Corp.**, Philadelphia, Pa. $2,-182,500. Equipment for overhaul of the AIM-9B, D and E missile. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-71-C-0127.

—**Aerodex, Inc.**, Miami, Fla. $1,342,234 (contract modification). Overhaul of T-56 aircraft engines. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F4601-69-D-3989.

—**General Electric Co.**, Arkansas City, Kan. $1,628,537. Overhaul of J-85 engines and components. Directorate of Materiel Management, Kelly AFB, Tex. F41608-71-D-0144.

24—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., awarded the following contracts:

North American Rockwell Corp., Anaheim, Calif. $2,459,036. Minuteman III post boost propulsion subsystems. F04701-68-C-70280.

TRW, Inc., Redondo Beach, Calif. $1,-154,330. Technical services for Minuteman II and III propulsion systems. F04701-70-C-0301.

—**Hayes International Corp.**, Birmingham, Ala. $2,628,329. Inspection and repair as necessary (IRAN) of KC-97 aircraft. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601-70-C-3370.

—**Emerson Electric Co.**, St. Louis, Mo. $2,-976,440. Electronic equipment for testing the C-141 aircraft's all weather landing systems. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603-71-C-0112.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Dynamics Corp., Fort Worth, Tex. $7,550,100. F-111 aircraft AF33 (657)-13403.

Hughes Aircraft Co., Tucson, Ariz. $1,-850,014. Rehabilitation of AF Plant No. 44. F33657-70-C-0805.

25—**Lockheed Aircraft Corp.**, Marietta, Ga. $6,-648,780. C-5A spare parts. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657)-15053.

—**J. J. Cook Construction, Inc.**, Oklahoma City, Okla. $2,074,000. Construction of 100 family housing units, Tinker AFB, Okla. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34650-71-C-10125.

—**Lockheed Aircraft Corp.**, Marietta, Ga. $1,-606,427. Modification of C-141 aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-8835.

28—The Ogden Air Materiel Area, AFLC, Hill AFB, Utah, awarded the following contracts:

Sargent-Fletcher Co., El Monte, Calif. $1,570,920. 750-pound bombs. F42600-71-C-1180.

LTV Electrosystems Inc., Greenville, Tex. $2,337,127. Supplies and services for inspection and repair as necessary (IRAN) of F-101B aircraft. Greenville, S.C. F42600-71-D-0001.

—**AVCO Corp.**, Wilmington, Mass. $2,750,-888. Fabrication and testing of Mk 11C Minuteman reentry vehicle. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0242.

29—The Space and Missile Systems Organization, AFSC, Los Angeles, Calif., issued the following contracts:

Honeywell, Inc., St. Petersburg, Fla. $1,409,527. Guidance and control systems for Minuteman III. F04701-69-C-0176.

TRW, Inc., Redondo Beach, Calif. $11,-490,000. Development of a computer program for utilization of Minuteman II and III. F04701-70-C-0179.

—**Holmes and Narver, Inc.**, Los Angeles, Calif. $2,624,581. Continuation of maintenance and operation of the Point Barrow Navy Research Site from Oct. 1, 1970, to Sept. 1, 1971. Alaskan Air Command, Elmendorf AFB, Alaska. F65517-69-C-0001.

—The Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, issued the following contracts:

General Electric Co., Cincinnati, Ohio. $102,217,094. TF-39 engines. Evendale, Ohio. AF33(657)-15003.

Republic Electronic Industries, Inc., Melville, N.Y. $1,283,136 (contract modification). Design and fabrication of a test set for the maintenance of airborne navigation equipment. F33657-70-C-1005.

Teledyne Ryan Aeronautical Co., San Diego, Calif. $9,285,806. BQM-34A aerial target drones, spare parts and special support equipment. F33657-71-C-0131.

General Dynamics Corp., Fort Worth, Tex. $15,687,030 (contract modification). F-111 aircraft. AF33(657)-13403.

30—**The Boeing Co.**, Seattle, Wash. $32,797,-800. Minuteman III missile spare parts and force modernization ground equipment. Seattle and Ogden, Utah. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0136.

Defense Industry Bulletin
Defense Supply Agency
Cameron Station, Alexandria, Va. 22314

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Blue Ribbon Action Committee Appointed

Secretary of Defense Melvin R. Laird has announced a Blue Ribbon Action Committee to work on implementation of decisions made by himself and Deputy Secretary of Defense David Packard to achieve improvements in Defense Department management.

Secretary Laird stated the mission of the committee is not to restudy the work of the Fitzhugh Panel, but to expedite the implementation of decisions as they are made.

"This committee," he said, "will work out the details of the implementing [actions] . . . so that there will be no interruption to continued combat readiness of our forces."

The committee is headed by Assistant Secretary of Defense (Administration) Robert F. Froehlke. Other members of the committee, and the Service or Defense Agency they represent are:

- Office of the Secretary of Defense—David O. Cooke, Deputy Assistant Secretary of Defense (Administration).
- Office of the Joint Chiefs of Staff—Vice Admiral John P. Weinell, Director, J–5 (Plans and Policy).
- Department of the Army—Major General David S. Parker, Chairman, Special Review Panel, Office of Army Chief of Staff.
- Department of the Navy—Rear Admiral Frank W. Vannoy, Assistant Deputy Chief of Naval Operations, Plans and Policy.
- Department of the Air Force—Major General George J. Eade, Director of Plans, Office of the Deputy Chief of Staff, Plans and Operations.
- Marine Corps—Brigadier General Herbert L. Beckington, Assistant Director of Personnel, Headquarters, U.S. Marine Corps

Navy To Retire 58 Ships

Secretary of the Navy John H. Chafee has announced plans to retire 58 additional ships. The retirements are a continuation of the Navy's program to adjust to fiscal restraints and to remove older vessels from the Fleet.

Nine of the 58 ships are major combatants, with the remainder being auxiliary, amphibious warfare and mine warfare ships. The aircraft carrier USS Shangri-La (CVS–38), homeported in Mayport, Fla., is the largest of the ships, with a total complement of 1,630 officers and men.

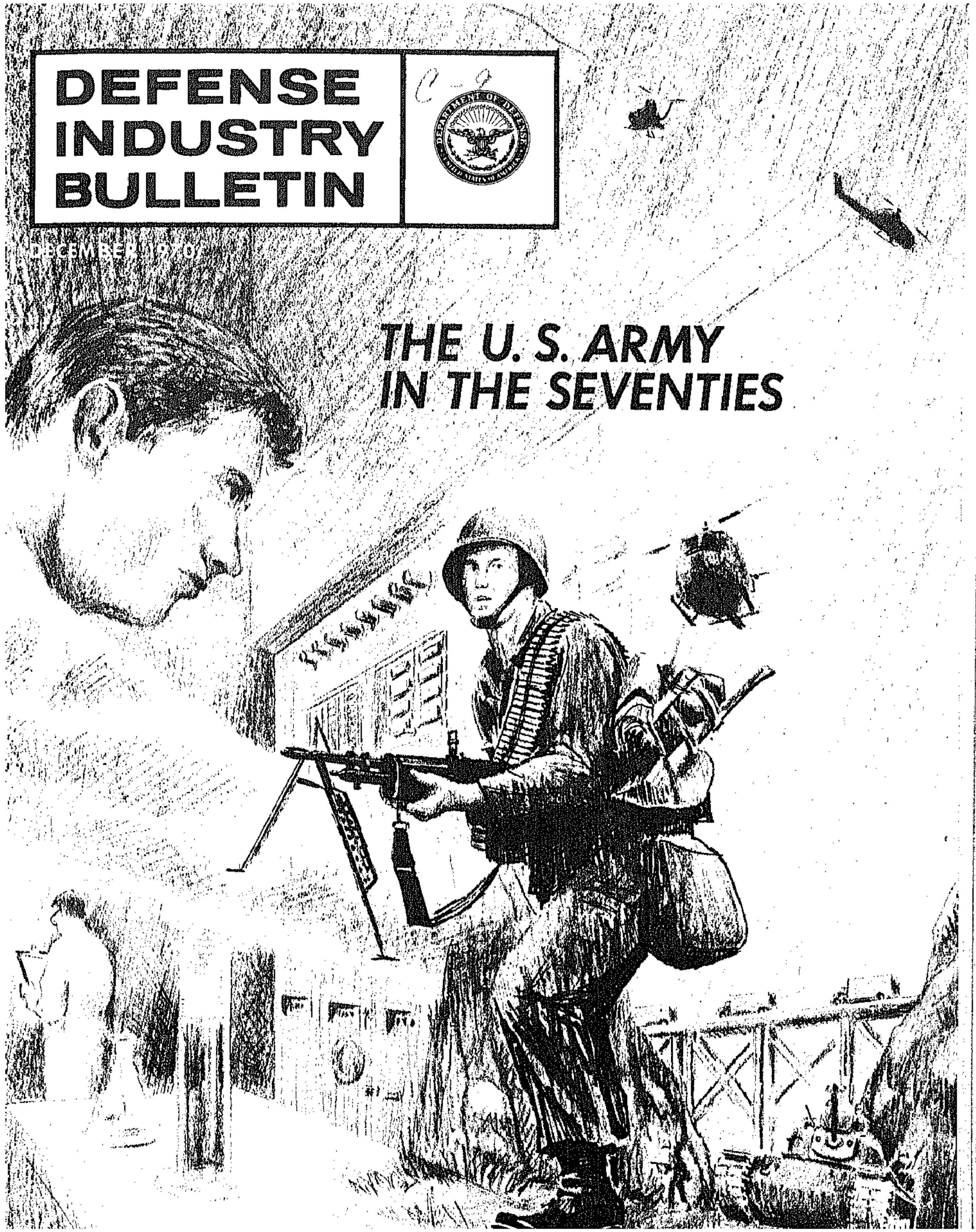
About 483 officers and 6,551 enlisted men are assigned to the designated ships.

The average age of the ships is 21 years, with the oldest age 27. The Shangri-La is 26 years old. Thirty of the ships are assigned to the Pacific Fleet; 28 to the Atlantic Fleet.

DEFENSE INDUSTRY BULLETIN

DECEMBER 1970

THE U.S. ARMY IN THE SEVENTIES



DEFENSE INDUSTRY BULLETIN

Vol. 6 No. 12 December 1970

Published for Department of Defense by Defense Supply Agency

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The *Defense Industry Bulletin* is published monthly by the Defense Supply Agency for the Department of Defense. Use of funds approved by the Director, Bureau of the Budget, Nov. 2, 1965.

The *Bulletin* serves as a means of communication between the Department of Defense, its authorized agencies, defense contractors and other business interests. It provides guidance to industry concerning official DOD policies, programs and projects and seeks to stimulate thought on the part of the Defense-Industry team in solving problems allied to the defense effort.

Suggestions from industry representatives concerning possible topics for future issues are welcome and should be forwarded to the Editor at the address shown below.

The *Bulletin* is distributed free of charge to qualified representatives of industry and of the Departments of Defense, Army, Navy, and Air Force. Subscription requests should be submitted on company letterhead, must indicate the title of the requester, and be addressed to: Editor, Defense Industry Bulletin, Hq., Defense Supply Agency, Alexandria, Va. 22314.

IN THIS ISSUE

FEATURES

DEPARTMENTS

The Future Army—A Volunteer Force

Excerpts from address by Gen. W. C. Westmoreland, USA, Chief of Staff, U.S. Army, at Annual Meeting of the Assn. of the U. S. Army, Washington, D. C., Oct. 13, 1970.

I am announcing today that the Army is committed to an all-out effort in working toward a zero draft—a volunteer force. In accepting this challenge, we in the Army will bend every effort to achieve our goal. But we need support and understanding from the Administration, the Congress, and our citizenry.

As you know, the Army is in a period of sweeping transition. We are redeploying forces from Vietnam, inactivating units, and reducing the size of our support base in the United States in order to come within reduced budgets. And we are still fighting a war. We currently have 300,000 Army troops in Vietnam. By next summer, after the withdrawal of those troops announced by the President, about 200,000 soldiers will remain. This is a large force executing an important and difficult mission. These forces must be supported for as long as the President chooses to keep them in action.

* * * * *

If this nation supports the President's chosen course in ending the Vietnam War, I believe the draft must be extended beyond its expiration date of June 30, 1971. Additionally, we must appreciate that movement toward a volunteer force will take time and continuation of selective service will guarantee a transition period without jeopardizing this nation's defenses. And finally, and most important, even though we reach a zero draft, selective service legislation should remain in force as national insurance.

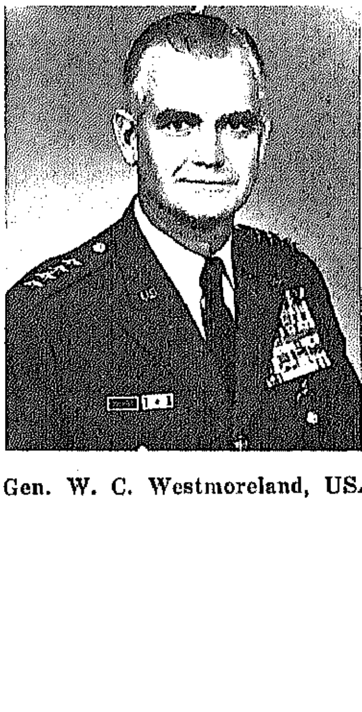
I am well aware of arguments both for and against selective service. Furthermore, I recognize that the Administration has committed itself to reducing the draft to zero. But I am also aware of the problems that confront the Army as we move toward a zero draft.

The Army's strength is a function of the combined capabilities of both its active and Reserve components—the "one Army" concept. Therefore, as our active forces decrease in size, the Reserve components take on increased importance. Both are vital to this nation's military capability, and both will be affected as we move toward a zero draft. A significant part of this country's military potential and one frequently ignored is the Individual Ready Reserve—a manpower pool of almost one million trained reservists who could be used in national emergency to fill Reserve as well as active units. This necessary adjunct of the Army Reserve is sustained by current selective service legislation.

We know that many in Army Reserve components are motivated to enlist as an alternative to being inducted. In view of this, a large part of our problem is to increase the number of volunteers in the Army Reserve and National Guard at the same time we increase volunteers in the active Army.

How we manage the transition from an Army of over a million and a half men to one very substantially smaller is crucial in our movement toward attracting more men.

- If we decrease our active forces in such a way that we are required to force out of the Army a significant number of volunteer officers and men who have already established their professional commitment and ability—some with two or more years of active combat—we will hardly be



Gen. W. C. Westmoreland, USA

in a good position to attract new men into our ranks.

- Conversely, if we confront our young sergeants and junior officers with no chance for promotion for many years, we face the prospect of losing many of our most capable young leaders. At the same time, we present a dismal picture of career attractiveness for those we wish to recruit. If we are to attract and, more importantly, retain young talent, reasonable opportunities for advancement must exist.

We cannot have the Army our nation needs without good people. We need quality as well as quantity and in the appropriate skills to meet our needs. This is our primary task. We accept it as a matter of the highest priority and utmost importance.

Success can only be achieved by a concerted effort in four areas simultaneously:

- First, those of us in uniform in positions of high responsibility in the Army must attack this problem with all of the vigor, imagination, and dedication we can muster, and we must apply ourselves intensively to the task.

- Second, we must eliminate unnecessary irritants and unattractive features of Army life where they exist. But we will hold to those immutable principles of dedicated professionalism, loyalty, integrity of character and sacrifice. They are the hallmarks of a disciplined, responsible Army. All else is secondary. Young Americans thrive on challenges and high standards. We must ensure that all activities have a perceivable need. Understandably, exercises without a justifiable purpose "turn them off."

- Third, we will not achieve our goal without the application of resources, and I mean money. We will need to increase pay. And we will probably find that we must put our money primarily in those jobs which are most arduous and have the least application to civilian pursuits—the infantry, artillery, and armor. We will need money for housing our people—an item for which we have deferred needed expenditures throughout the Vietnam War. We will need money to maintain those houses. We will need modern barracks. We will need money for civilian labor contracts so that our helicopter mechanics are not cutting grass and our radar technicians are not washing dishes.

- Fourth, we will need the support of the American people and their leaders in business, industry, the church, education, and the news media. We cannot attract the kind of soldier we need into an organization denigrated by some, directly attacked by others, and halfheartedly supported by many. This country cannot have it both ways. If the Army is portrayed and believed as a military service to be avoided at all costs, a Service in which only those with the least qualifications need be recruited, and if we do not have the active help of community and national leaders in every field, even money will not do the job.

Success is required in these four areas if we are to achieve our goal. But the Army has sufficient control to produce what is required only in the first two. We can attack the problem immediately and energetically. And we can work toward making life in the Army more attractive for those young men we want to volunteer. But in the other two areas, we need help from the Administration, the Congress, and the citizenry of our nation.

I hereby commit the Army to the achievement of the first two objectives.

* * * * *

I am appointing a senior general officer as project manager, reporting directly to me and to Secretary [of the Army] Resor. His mission is to raise to the maximum extent possible the number of enlistments and reenlistments in both the active Army and Reserve components. This officer will have authority similar to that of the project managers of major weapon systems currently in the Office of the Chief of Staff.

Second, we are immediately increasing the size and quality of our recruiting effort.

And third, at all levels throughout the Army, senior officers will be charged personally with the responsibility for increasing the retention of good people, both by improving the living standards of their men and families and by an intensive effort to capitalize on the many attractive features of Army service.

Our Army is an organization of young people. Today the average age of those in the Army is less than 23 years. Over three-fourths of our enlisted strength has less than three years of service. The young men who are and will become our soldiers and junior officers have attitudes that differ from those of our older group of officers and noncommissioned officers. To ignore the social mores of this younger group is to blind ourselves to reality. Their values and attitudes need not necessarily be endorsed by Army leadership, yet we must recognize that they do exist. We must make military service life better understood by those who fill our ranks.

We will leave no stone unturned. We are willing to part from past practices where such practices no longer serve a productive and useful end. We are reviewing all our policies and administrative procedures. Nothing is considered sacrosanct except where military order and discipline—the soul of the Army that ensures success on the battlefield—are jeopardized. In this, we cannot and will not yield. We will continue to hold to the principles that have traditionally guaranteed this nation a loyal Army.

Those of you who have worn the uniform of our country look back on your service with satisfaction and pride. After the dust has settled, I am sure such will be the case with our younger generation. The important thing is that the Army not only provides an opportunity for the young people of our country to serve proudly but also provides them an opportunity to prepare themselves to be better and more effective citizens.

Today, the Army of the United States has committed itself to moving toward a volunteer force with imagination and full energy. But our success will require the assistance and support of the Administration, the Congress, and the public.

Our efforts, alone, will not be enough. All citizens must do their part. We will need assistance from many quarters. We invite your help.

Budget Constraints Require Greater Selectivity

Address by Hon. Robert L. Johnson Asst. Secretary of the Army (Research and Development) at Sustaining Members Luncheon, Annual Meeting of the Assn. of the U. S. Army, Washington, D. C., Oct. 14, 1970.

I know you are all well aware of the environment we work in—declining troop strengths, fewer dollars and, not necessarily on the same order of magnitude, public and Congressional pressure to do with less. These hard facts of everyday life place a tremendous responsibility on our shoulders. Notice I say *our* military and industry shoulders; for in such an environment, military requirements and industrial costs must be realistic, rock-bottom necessities adequate to appropriately provide for our national defense. As [Secretary of the Army] Resor stated:

> "We know that we cannot let the quality of our force decline with its number. We must develop the weapon systems which we will need by the end of the decade. We also must balance our needs for development against our procurement requirements so that we do not slight either of the vital interests involved."

It is clear that we cannot attempt to carry through development and deployment of nearly all the attractive schemes for new systems. Just because a very difficult, expensive, challenging project seems possible, and some people want to do it, is not in itself a sufficient reason for its undertaking. There must be a better reason for allocation of scarce resources.

One of the things we can do is to be selective as we attempt to focus short program dollars. We should only start development programs that we can finish. Those which we start ought to very clearly have the highest priority so that, in fact, they are well established and we can maintain their funding. Slipping of funding, dropping of funding, slowing of funding are major causes of cost growth and wasted money. So, clearly, a better job of selectivity for the real requirements is something we can do.

Industry can structure its independent research and development program to provide support of the pivotal technologies that we will need in the future. Industry must be as selective as the Services in deciding which programs or projects will be fully funded because benefits accrue to both parties.

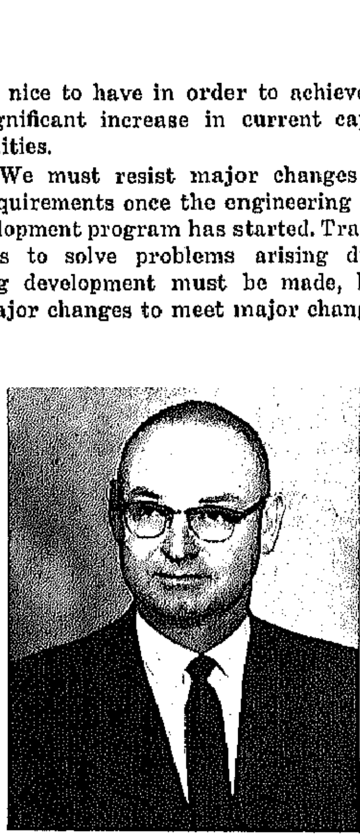
A thorough tradeoff analysis should be made before development of a new major weapon system is started. After examination and analysis of all pertinent factors, an acceptable solution may be improvement of existing systems or an increased deployment of the fielded system.

Very few weapon systems are so essential that they must be developed regardless of cost. The atomic bomb was such a weapon. The ballistic missile and the Polaris submarine may be in the same category; however, weapon systems of this importance do not come along very often.

One of the very best ways to reduce costs is to scrub our requirements to ensure that new capabilities are limited to essentials. This has the added advantage of reducing the complexity of new weapon systems.

We must remove every non-essential item that does not contribute to combat effectiveness. In some cases, we may even have to accept a degradation of effectiveness we think would be nice to have in order to achieve a significant increase in current capabilities.

We must resist major changes in requirements once the engineering development program has started. Tradeoffs to solve problems arising during development must be made, but major changes to meet major changes



Robert L. Johnson is Assistant Secretary of the Army (Research and Development). Prior to his appointment to this position, he was Vice President for the MOL Program and Assistant General Manager of the McDonnell Douglas Astronautics Co., Western Division. He held key engineering and administrative positions in the Douglas Aircraft Co.'s missile and rocket programs from 1946 until the merger with McDonnell Aircraft Co. in 1967. Mr. Johnson holds B.S. and M.S. degrees in mechanical engineering from the University of California at Berkeley.

in requirements cannot be done without loss of time and considerable increases in cost. If we have done our homework properly before the project is initiated, major changes in requirements will not be necessary.

In addition to the many performance requirements which must guide system and detail design, I would like to propose several more that flow directly from reduced strengths and lower budget. This will mean fewer men to man our systems and conscious action must be taken to reduce the number of men required to operate and maintain them in the field. This is also one aspect of reducing life-cycle costs which is another area requiring attention. Then there is the problem of the magnitude of initial acquisition costs. Between systems which have equal life-cycle costs, that system with the lower initial acquisition cost will almost always be preferred because of the pressures of near-term budgets.

The ever present problems of reliability and quality assurance are those which industry is uniquely qualified to address. Techniques of system and detail design for reliability, proper component and subsystem environmental testing, and the array of quality control activities are specialties which must be properly applied. Equipment which operates properly over the expected span is the hall-mark of a company of high integrity.

We should adopt contracting procedures consistent with development unknowns. We must recognize the uncertainties inherent in any significant development program involving substantial departures from prior designs. Our methods of contracting must allow the flexibility required on the part of both industry and Government, implying a considerable dependence on cost plus incentive type contracts.

In the past we, perhaps, relied too much on paper studies in lieu of testing hardware. You probably remember the catch phrase: "Paper costs less than metal." I would be the first to admit paper studies have their place, but some full scale engineering tests are necessary to resolve certain high technical risk elements of a program. Such testing is included in the concept presently identified by the phrase: "Fly before you buy."

We must have adequate testing before production. A test program that produces the data we need for decisions can be developed without becoming an unnecessarily long time-consuming program.

I know that some in both the military and in industry view the forthcoming decade with great anticipation and, in some cases, horror, at the thought of austere budgets and forces. I, however, view it quite differently. I see the period as a most challenging and exciting era in which we are all called upon to put forth our greatest talents in meeting the Army's contribution to the defense of the nation. I look forward confident of success.

Modernization: The Army of the 1970s

Presentation by Lt. Gen. George I. Forsythe, USA, Commanding General, Army Combat Developments Command, at Annual Meeting of the Assn. of the U. S. Army Washington, D. C., Oct. 13, 1970

This is undoubtedly a critical decade, a particularly significant turning point for the Army. This is so for many complex and interrelated reasons familiar to all of us. Suffice it to say that a combination of domestic, international, social and technological factors—all characterized by a dynamism unique to our rapidly changing world—make it imperative that institutions, public and private alike, take some good hard looks inward and outward.

The Army has taken such a look and come up with four specific goals which we call the four Ms—mission, motivation, management and modernization. . . . Modernization . . . is the real title for my presentation. We can scarcely talk about the Army of the 1970s without addressing the goal of modernization.

Progress, of course, is not a free commodity. It extracts its price. For the Army, progress is a continuing improvement in our capability to ensure the nation's security and defense. This is a worthy objective, to be sure, but one, nevertheless, that must be garnered at the least possible cost. This is no more than sound economics.

Like any other organization, the Army has a big say in determining how it will make its payments for progress toward optimum modernization. We have choices to make and

Lt. Gen. George I. Forsythe, USA

decisions to reach, all of which reflect a wide range of options from which progress can be derived. But all these choices and all these decisions must fall within the limits of our available and projected assets. That is a crucial point: We must get the most for our money and the most from our people.

This will be the big test of our adaptability in a dynamic world. This is the time to decide the steps we should take to maximize the premiums of a severely constrained investment base. Pursuing that particular line of thought, it is revealing to contrast our country's national defense investment base with that of our potential enemies. This can shed a lot of light on where we stand right now.

To make this comparison, or contrast, I suggest applying a concept of "cost tolerance," to which, incidentally, I was recently introduced by a young ROTC student. The concept or principle of cost tolerance is an especially illuminating frame of reference now when the Army is trying so hard to balance increased capability requirements against the reality of dwindling resources.

Cost tolerance can be defined as:

The measure of a nation's willingness to subsidize expenditures, both in terms of manpower and material assets, for purposes of national defense.

Our enemies have displayed a very high cost tolerance in committing resources to support the attainment of national or political objectives through the medium of military might. This tolerance shows, furthermore, little likelihood of diminishing. If anything, the opposite can be claimed if we will briefly examine Soviet and Warsaw Pact force structuring and strategy in Europe.

These forces are organized on the basis of the principle that shock action on the battlefield to maintain or turn the tide of combat is to be obtained through *mass*—massive and overwhelming applications of force. Forces are, therefore, oriented to massive armor and mechanized capabilities, massive artillery support, deployment of mass forces on narrow fronts, massive tactical air capabilities, and tactics of deep penetration with swift thrusts and multiple echelons to maintain pressure. All this reflects a high Communist bloc cost tolerance for the material and human resources that must be invested in order to equip and organize forces that are designed from a shock-through-mass strategy. The threat this poses is further enhanced in that the enemy shock force features a technological sophistication comparable to that of Free World forces.

Halfway around the globe in Southeast Asia we can again discern, in the example of North Vietnamese and Viet Cong tactics, that a high cost tolerance lies at the very heart of the unique shock capabilities of aggressing forces in the counterinsurgency, or low-intensity warfare, environment. While the level of technological sophistication may be inferior, more than sufficient compensation for this, appropriate to the form of combat being undertaken, is achieved to a great extent through a willingness on the part of this bizarre enemy to commit human resources extravagantly to attain military-political objectives. In fact, this extravagance with human life is a source of continual and real horror to our people because Americans, as a people, are accustomed to placing a high premium on human life. Unlike the Communist guerrilla, we are repulsed by "human wave" tactics employed with frequently only a slim chance for gain on the battlefield.

Turning our eyes inward now, we detect a multitude of complex trends in our society generating pressures against the draft, against a large army, and against the allocation of large sums of money from the national budget for hardware and systems development and acquisition. Clearly America's cost tolerance is at a lower level than that of our enemies, and for the foreseeable future would appear to be on an overall downward incline. Also, this trend will necessitate reductions in manpower strengths for our armed services.

So with increasingly fewer men we must provide a capability to effectively counter a threat that our intelligence tells us shows no promise of diminution. This is the very hub of the challenge to the Army of the 1970s: to accomplish that task. It isn't impossible, but it will call for great innovation, introspection and willingness to make adaptations. How can it be done?

It must be done by tremendously increasing each man's effectiveness by aiding him with machines and technology. This increase in effectiveness will simultaneously provide a corresponding increase in each man's survivability on the battlefield. But because material acquisition is also keyed to cost tolerance, we must ensure that the machines and technology not only are effective, but are used so as to stretch their utility to the maximum. This is the heart and soul of the modernization goal.

Thus, our forces must be structured to accomplish a maximization of materiel assets. This is a matter of getting ahead in the power curve with the designs of organizations and doctrinal concepts and techniques geared to derive the greatest possible benefit from each and every component of the force—whether that component is as elemental as the basic man/machine relationship of the soldier and the weapon and gear he carries into battle, or as complex as a systematic scheme for battle area surveillance or support structures.

What I've said to this point can be summarized in a basic assumption:

America's cost tolerance, in terms of manpower and materiel alike, will not support forces designed on the principle of *mass* as the means to match our mass-oriented enemies in achieving shock action in combat. Shock-through-mass is not and cannot be the U. S. strategy.

But we must prepare for military operations in this age of the shock army. We should do this by seeking and then adding shape and substance to an alternative that will defeat shock-through-mass.

Such an alternative is within our grasp today. Furthermore, it is to a good degree already reflected in the record of the past decade, characterized by astounding advances in firepower lethality and in the ground and air mobility of our combat forces in Vietnam. How successful we are in

moving forward toward this alternative will depend on our ingenuity in transplating the experiences of the 1960s and applying them innovatively to satisfy the tasks the Army faces in the years ahead.

I use the term "translate" deliberately, because it would be wrong to think that these experiences can be simply *transferred* wholesale. Unfortunately, it isn't that easy; but the seeds exist for creating a powerful alternative to shock-through-mass.

What is that alternative, and what relationship do the Army's current experiences and efforts bear to it?

Alternative to Mass

I contend that shock action on the battlefield can be created not only through mass and overwhelming power, but also through *agility* and *effectiveness*. Proper force structuring applying these two principles can result in shock to the enemy. Having used the term "shock" repeatedly today, I think this is the time to roll out a definition.

Shock can be defined as a loss of the opponent's physical ability to continue fighting. It can also be the loss of his *will* to continue fighting, a psychological consideration. It is loss of his freedom of action in selecting alternative and less costly courses of action that might permit him to continue fighting. Finally, it may be the loss of his hope for an acceptable outcome to the battle, another way of saying that he sees disaster as a certainty. Normally, of course, it is an interplay of several of all of these effects that ultimately undermines the fabric of the enemy's combat capability and causes it to disintegrate.

History records numerous instances where tactics of shock through *agility* and *effectiveness* have outstripped shock-through-mass. Stonewall Jackson was a master of agile and timely countermarches that defeated far larger enemy forces. Sherman, in his southward campaign from Chattanooga, delicately gauging factors of timing and effectiveness, chose to run away from his less agile and mobile support forces to beat starvation to Savannah where the fleet could replenish his units. Perhaps Napoleon, after his dashing campaign in Italy that brought the defeat of a massive Austrian force in 1797, best expressed the principle of an alternative to shock-through-mass when he chose, in his words, "to concentrate a temporary superiority of force *at the point of balance*."

By taking a somewhat more detailed look at agility and effectiveness, let us envision how today's Army can direct itself toward the design of shock forces that will be equipped, organized and trained to concentrate temporary superiority at the point of balance in engagements with more massive and overwhelming forces.

Agility is the quality of a combat force that lets it reduce its own vulnerability, concentrate or disperse its resources rapidly to retain a winning edge in the ever changing battlefield scenario, all the while denying to the enemy targets to overwhelm with his mass.

The key to agility is far more than mobility alone. The ability to move becomes agility only when the maneuvering force moves always to the right place at the right time and deals a blow that is precisely appropriate and sufficient for the situation, and when the ease and speed with which it accomplishes this surpasses the opponent's capabilities to react effectively.

Effectiveness encompasses those features of the agile force that actually enable it to strike the precision blow. Every shot should be, ideally, a sure-kill, striking the enemy where it hurts him the most, *i.e.*, at the point of balance. This pinpoint accuracy, in addition to relying on the performing efficiency of the system and all its material and human resources, must also rely on our ability to leave no enemy move undetected or unopposed, unless there is a deliberate choice made by the commander not to oppose at that particular juncture in the battle. So this is another "must" of effectiveness. Finally, effectiveness implies the ability to engage key components of the enemy's power apparatus and to defeat these quickly and completely. These key components—the points of decision making and command—may frequently be the point of balance, the destruction of which would cause a disintegration of the enemy's will, his ability, and his hope for victory.

Inherent in the principle of effectiveness—as in the principle of ability — is *timeliness* which is knowing in real time what both enemy and friendly forces are doing so that the commander will be able to achieve decisive results by employing agile forces with total effectiveness at the right time and the right place.

Nature of Battle

How do these alternative shock principles—these two alternatives to sheer mass—relate to the great potential on tap in the Army today? I want to bring that into focus now, and to do it I would like to take a look at the nature of battle itself and then play off some of our recent experiences and current efforts against this analysis to show how they might apply in a shock force such as I've just described.

There are some essential phases or activities involved in battle. The capabilities of a force are a direct reflection of how well these activities are accomplished.

A long time ago the platoon sergeant of my first rifle platoon taught me a marvelously simple and effective version of a combination of a conventional estimate of the situation and a field order. This was: *job, enemy, own troops, ground, ways, best way.*

If one examines the first four of these—job, enemy, own troops, and ground—one can quickly come to the realization that any combatant must have a thorough comprehension of these four *before* the battle is joined. Moreover, in the context of modern land combat, even though a vast amount of preparation must take place, this comprehension must occur with unprecedented speed.

We must obtain information about the intentions, strengths, weaknesses and missions of the opponent and then convert this into hard intelligence infinitely more rapidly than ever has been required in the past. One of the great possibilities to achieve an increased effectiveness in this activity of comprehension lies now in the surveillance, target acquisition and night observation (STANO) program. Despite the complexity of STANO—and complex it

assuredly is—it addresses one very fundamental question, *i.e.*, where are the enemy forces right now? If we can know that, in real time, then we can derive far greater capabilities from our own units.

We must be able to completely comprehend the status of our *own* troops. The winner in battle will be the combatant who can create the proper force apparatus. This shouldn't be confused with creating a force structure; rather, it is organizing from one's assets a task structure appropriate for the situation as assessed by the commander from the intelligence at his disposal. Within the contention phase of combat, we must apply this task structure at the right time and place—the point of balance—to produce shock. Here our fires must be precise and effective; maneuver, keyed to timely information about vulnerable enemy targets, must be precise and decisive. The combination of precision fire and precision agility equals shock.

Integrated Battlefield Control

The concept of a battlefield where every unit can be deployed in the right strength at the right time and in the right place is Utopian. No one ever will get to that. But we can and must approach that concept. Our units' high-speed capability in movement to and into battle long since has outstripped Von Steuben's command and staff system. The result has been described as an "intelligence and control gap." Measures must be taken to ensure that our combat decision makers are kept up to speed.

The automatic data processing techniques associated with STANO and with other approaches to this problem, such as Tactical Operations System (TOS), the Tactical Fire Direction System (TACFIRE) and the Combat Service Support System (CS_3), provides vast potential for a follow-on concept we call the integrated battlefield control system—or eye-bix.

The standard and doctrinally sound *way* of "having two up and one back" may be in for substantial revision when we have real-time comprehension about our job, the enemy, the ground—and by this I mean the total environment—and our own troops. It may be that we will be provided many *ways*—many new and exciting options never before available.

And, of course, this same rapid access to hard intelligence will mean that truly the *best way* will be chosen as the course of action to be pursued decisively.

Implicit in my preceding remarks is the fact that the Army has a mobility potential that will require a stepped up command and staff system.

Basic Combat Forces

Throughout history there have been measurable phases of mobility and readily identifiable classification of combat forces. The basic types of combat forces have been, and still are, infantry, light cavalry, heavy cavalry and fire support.

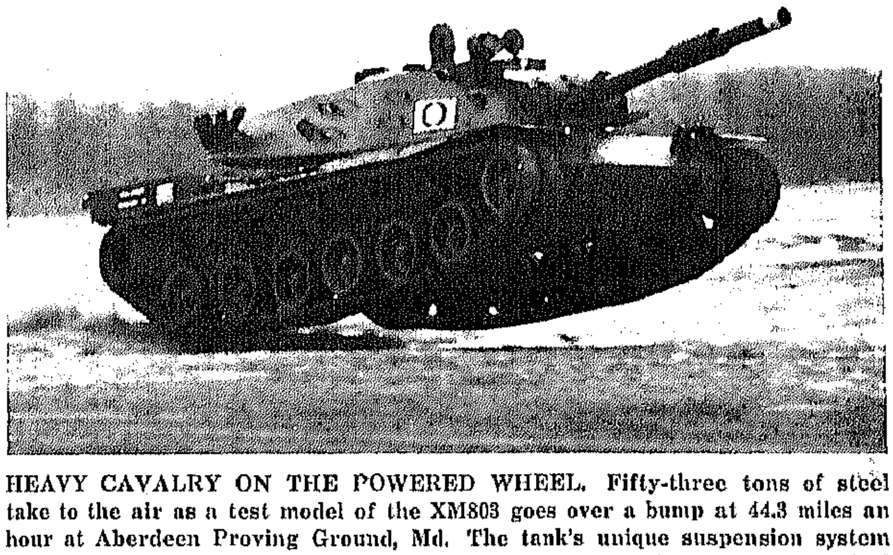
The mobility of these forces evolved in three phases. At first, mobility was made possible by walking or running legs—infantry walked on its own legs; cavalry moved on horses' legs; and fire support forces moved by leg power. When the wheel was used, it still relied on the leg as the prime supplier of motive power.

Then the wheel was combined with the modern internal combustion engine and the walking infantry became motorized infantry. The light cavalry went to the powered wheel, and the result was the famous jeep of World War II; and the light, agile, mechanized reconnaissance vehicles of the 1940s and 1950s.

What about the tank? The tank is nothing but heavy cavalry on the powered wheel except, of course, that it happens to lay its own road and pick it up as it goes along. Fire support artillery, both self-propelled and towed, have similarly adapted the powered wheel.

This "progression" really brings the point home to roost, I think. In the few years past, we have seen the rotating airfoil become a new means of giving these types of forces a great mobility advantage. We have airmobile infantry—which is infantry retaining many of its traditional roles and missions—obtaining its mobility from the rotating airfoil. Light cavalry, which is represented by our air cavalry squadrons, is the logical marriage of the rotating airfoil to the classic cavalry organization.

Artillery has taken to the air, both with its aerial rocket artillery and



HEAVY CAVALRY ON THE POWERED WHEEL. Fifty-three tons of steel take to the air as a test model of the XM803 goes over a bump at 44.3 miles an hour at Aberdeen Proving Ground, Md. The tank's unique suspension system makes possible high speeds over rough terrain, and contributes to its tactical capabilities.

with the use of the medium and heavy lift helicopters as the prime mover of conventional tubes.

So *now* the question is: What about the rotating airfoil and heavy cavalry? Obviously, the tank is here to stay. Moreover, the tank in the 1970s is going to be very much like the tank we have known in the past. We hope that the U.S. army tank is going to be the XM803 [formerly called MBT70], which is a marvelous machine. Agile and effective, this tank, pound for pound, bids fair to be the meanest ground fighting vehicle in the world.

But there is another weapon system on the horizon that, in my opinion, belongs in the heavy cavalry classification. This is the attack helicopter, which, in its prototype form, is known as the Cheyenne. The mobility of the attack helicopter, as a companion to ground armored assault forces, holds extraordinary promise as a means to achieve an alternative to shock-through-mass. The unmatched capability of the attack helicopter to pop up, fire, and then drop out of sight makes it an exciting prospect as an agile and effective descendent of the tank destroyers of earlier days. This will be particularly true when it is properly supported by hard intelligence to ensure that it is employed with *timeliness.*

Forces consisting of appropriate mixes of combined air and ground capabilities offer a unique potential in providing the Army with sufficient shock power within the limits of cost tolerance. This combination may well emerge as the latest chapter now being written in the history of heavy attack cavalry.

Success in battle is achieved when the victorious force has *compelled* the opponent to behave as the victor desires, or instead face the alternative of paying a prohibitive price in casualties, time, or loss of purpose. To compel a force with the vast potential of mass to behave as we wish will not only require the lightning strokes at the point of balance at the outset, but also will require that we maintain continuous pressure throughout the full course of the operation. This continuous pressure on the enemy—to confound his capabilities and blunt his initiatives—will take great staying power. The key to this is support.

The field of logistics is truly the area of the "big re-think" today. No longer can we assume that present operating procedures will be acceptable in the constrained shock army emerging on the horizon. To match this agile, effective, timely shock force, we must tailor a logistics scheme with comparable speed and effectiveness. Using giant jet aircraft, rapid deployment logistics ships, and reliable utility and heavy lift helicopters, we will have to institute a new concept of a mobile logistical pipeline with a flexible "hose" capable of squirting support directly to the user at the moment that it's needed. This will call for processes that allow units to transmit their support requirements instantaneously to the source of support. It will call for processes that allow that support source to sift incoming requests rapidly to assign priorities when this would seem necessary. It will call for processes, in summary, which enable the delivery of support with unprecedented speed and ease to match the momentum of shock combat units. Thus, our combat service support system effort, called CS_3, relies heavily on automatic data processing and information assessment techniques and the entire logistics capability must be supported by extremely responsive communications linking the logistics hose with the combat force.

Underlying the entire concept of agile and effective shock forces in all the activities or phases of battle is the requirement to *conserve* our power sources, command apparatus, and freedom of choice or initiative. The conservation of resources is especially significant when viewed again in terms of cost tolerance levels dictating the investment base for our national defense. The shock force that places a premium on agility, on effectiveness, and on timeliness in constrast to sheer mass is by its very nature exceptionally oriented toward conserving its resources.

The most priceless resource is, of course, the human one. Over the years we have been inclined to think of the combat infantryman as "the lone man at the end of the line." There is a compelling drama to this symbolism, involving as it does the courage and spirit that, when all is said and done, is the final determining factor in our combat effectiveness. Nevertheless, I think the Army of the 1970s will be bringing some transformations in the ways and means of conducting battle that will greatly modify the imagery in "the lone man at the end of the line."

This is because, as we move closer to the agile and effective shock army, we are going to see some phenomenal progress in our ability to *conserve* the lives of our men. The basic role of the infantry—to seize and hold—will remain the same, but the way this role is performed is in for startling innovations and modifications.

The role of man in battle will be changed—not because machines have been substituted for him—but because *machines* and *technology* have *increased* his *effectiveness.* He will be able to stand off and strike lethal blows at the enemy, all the while retaining an unprecedented high degree of survivability.

Man will have to find the enemy, but he will have technology to help him to do this and to conserve his vital energy.

Man will still have to fix the enemy, but he will enjoy the use of agile, effective weapon systems to make that *fix* at stand-off distances.

The fighting will be done, not by man protected only by the shirt on his back, but by these same weapon systems that increase his striking power while reducing his vulnerability.

I have spoken of some of the modernization programs and objectives that will, I believe, be essential to the future of the Army of the 1970s. We face a grave threat and the cost tolerance of this nation provides an increasingly austere investment base, with which to counter that threat.

We must create, then, a force capable of meeting the threat of shock through mass.

This is the role of those of us in the Army charged with charting that course—to design a modernized shock Army keyed to the nation's cost tolerance.

I am confident we can do exactly this by keeping our eyes on this simple equation—*agility plus effectiveness equals shock.* That really says it all.

Naval Ordnance Laboratory

From Concept to Hardware

Dr. Gregory K. Hartmann

A metal that remembers its shape.

An explosive that sets the Apollo crew on the moon.

An antisubmarine missile that goes from underwater to air to underwater.

Glass that gets stronger in the sea.

These are just some of the developments that have come from the Naval Ordnance Laboratory (NOL) at White Oak, Silver Spring, Md.

For 50 years the laboratory has conducted a program of warfare analysis, research, design, development, test, evaluation, systems integration, and fleet engineering support in weapon systems, principally in the areas of surface and undersea warfare. It has also conducted investigations into related fields of science and technology.

A staff of approximately 3,000 and a budget of $70 million permits pursuit of weapons development from the most basic studies to the point of readiness for fleet use. A portion of each year's budget is allocated to independent research—self-directed inquiry into problems of aeroballistics, chemistry, mathematics and physics that have a relevance to eventual military objectives.

NOL is under the administrative control of the Naval Material Command (NAVMAT), and receives 13.6 percent of its funding from its parent organization. Over 70 percent of its support comes from the various NAVMAT systems commands; the balance from the Air Force, the Army, Defense Atomic Support Agency, National Aeronautics and Space Administration, and miscellaneous sources.

The laboratory is headed by a military commander and a civilian technical director, with the commander responsible for the overall operation of the laboratory, and the technical director for the conduct of the technical programs.

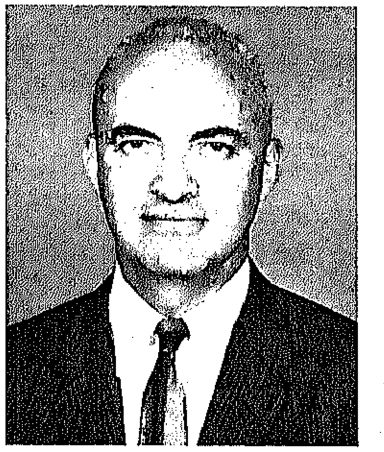
Organizationally the laboratory is arranged into two research areas, two engineering development areas, and two principal support areas, each under an associate or assistant technical director. Three staff groups—the management staff, the personnel office, and the advanced planning and analysis staff—report directly to the technical director and commander.

Below these broad areas of management, the laboratory is organized into departments by scientific and engineering disciplines.

In addition to the plant at White Oak, NOL maintains three major field facilities which are used to help determine the reliability of prototype weapons under actual sea conditions. Evaluation of mines and air-dropped weapons is done at Solomons, Md.; mines at Fort Monroe, Va.; and mines, air-dropped and underwater launched weapons at Fort Lauderdale, Fla.

Throughout its 50-year history, NOL has developed a partnership with industry in the performance of its mission by using commercial products, by encouraging industry to pick up the research and development where NOL leaves off, or by industry participation on the development and production team.

In its search for a non-corrosive, non-magnetic material for tools for underwater repair of magnetic apparatus, NOL led in the development of a new class of non-magnetic metals. From this independent research has come an amazing metal called nitinol—the metal with a memory. An alloy of titanium and nickel, nitinol's properties can be varied by changing the proporton of nickel and titanium, or through the addition of other alloying elements. In one form, nitinol wire can be bent, coiled, or crushed and, if



Dr. Gregory K. Hartmann has been Technical Director of the Naval Ordnance Laboratory since 1955. He has served at NOL since 1946, first as head of the Explosives Department and later as Associate Technical Director for Research. He holds a B. S. degree in physics from the California Institute of Technology and was a Rhodes Scholar at Oxford University, where he received a B. A. degree in mathematics with a special subject in relativity. He received his Ph.D in physics from Brown University.

moderately heated, will return to its original shape.

This feature makes the wire attractive for many commercial uses such as self-erectable space structures, thermally actuated devices (fire and safety devices), self-actuating fasteners, and the principal component of heat-mechanical energy converter (the repeating cycle heat engine).

NOL continues its interest in nitinol research, but much of its further development and all of its production is being conducted now by industry.

Glass that gets stronger in the sea is another example of the way industry and NOL have teamed up to develop new materials.

NOL pioneered the use of glass for submersibles and sought ways to strengthen glass to make a suitable material for moisture-contacted structures. Industry has been doing the same thing.

Surface-compression strengthening by ion-diffusion has resulted in a glass that *gains* in strength after immersion in the sea. To determine if these methods of strengthening did indeed increase the strength of the glass, NOL conducted a recent series of tests. Five types of commercial glass, each strengthened by the manufacturers' own ion-diffusion processes were used. Test results showed an increase in "design-allowable" strengths of at least 6 percent, and in one material of 46 percent.

Tests were conducted in the ocean for 18 months and for 3 years in the laboratory at NOL in circulating simulated sea water. Specimens were held at constant bending stress from 20 percent to 70 percent of the average ultimate bending strengths of the materials.

The specimens were bent in a strong arc throughout the exposure periods. All sprang straight after release, with no evidence of cold flow.

The results of these tests point to future use of surface compression strengthened glass to form many structures, vehicles, or devices for use in a marine environment. Industry, as well as the Navy, can find many uses for such a construction material.

Not all work performed by NOL is done for the Navy. Money from NASA enabled NOL to develop hexanitrostilbene—a stable explosive

Key Personnel Directory

U. S. Naval Ordnance Laboratory

White Oak
Silver Spring, Md. 20910
Phone: (301) 434-7200

Commander—Capt. G. G. Ball, USN

Technical Director—Dr. G. K. Hartmann
- Advanced Planning & Analysis Staff—Dr. C. M. Schoman Jr.

Assoc. Tech. Director & Head, Research—Dr. D. F. Bleil
- Applied Physics Dept.—Dr. W. W. Scanlon
- Physics Research Dept.—Dr. Z. I. Slawsky
- Chemistry Research Dept.—Dr. A. Lightbody
- Explosions Research Dept.—Mr. C. J. Aronson

Assoc. Tech. Director & Head, Aero- and Hydroballistics—Dr. R. E. Wilson
- Aerodynamics Dept.—Dr. L. Schindel
- Ballistics Dept.—Dr. A. E. Seigel
- Mathematics Dept.—Dr. E. K. Ritter

Assoc. Tech. Director & Head, Air and Surface Weapons Development—Dr. J. S. diRende
- Air & Surface Mechanical Engineering Dept.—Mr. J. H. Armstrong
- Air & Surface Electrical Engineering Dept.—Mr. E. M. Williams
- Air & Surface Evaluation Dept.—Mr. R. E. Grantham

Assoc. Tech. Director & Head, Underwater Weapons Development—Mr. W. B. Anspacher
- Underwater Mechanical Engineering Dept.—Mr. C. F. Bowersett
- Underwater Electrical Engineering Dept.—Dr. E. H. Beach
- Underwater Evaluation Dept.—Mr. J. M. Martin

Asst. Tech. Director & Head, Engineering Support—Mr. P. J. Martini
- Environmental Evaluation Dept.—Mr. V. M. Korty
- Engineering Services Dept.—Mr. E. H. Langenbeck
- Product Engineering Dept.—Mr. H. H. Varhus

Assistant Commander & Asst. Tech. Director & Head for Administrative & Logistic Support—Capt. R. Ennis, USN
- Public Affairs Office—Mr. G. F. Kahne

[Editor's note: This listing includes only those key personnel of NOL considered to be of most interest to industry.]

with a formidable name. Because of NOL's expertise in the field of explosives, NASA requested the laboratory to recommend or develop an explosive suitable for use in the seismic experiment package that is to be used in its study of the lunar surface. It must be stable enough to stand the journey to the moon and to remain in the moon's rugged environment with its extremes of temperature, without evaporation or detonation before signal. The explosive, called HNS for short, will be used by NASA for the seismic testing in an upcoming moon mission.

However, it has already been of considerable benefit to the Apollo program—triggering the release of the landing gear of the lunar module to assure a soft landing; separating the ascent stage from the descent stage to permit the return of the lunar module to the command module; and after the astronauts were safely abroad the command module, separating the lunar module and setting it adrift in space.

Aside from space use, as a device to get things to operate, HNS offers a potential to the oil industry. Deep oil wells need a thermally stable explosive to start the flow of oil. HNS may prove to be the answer to these needs.

Phase Plan

The laboratory is annually engaged in the development of weapon systems, subsystems and components to the extent of 69 percent of its budget. It owes much of its success in the area to the Phase Plan, an orderly process whereby a project proceeds by discrete steps from design to production (Figure 1).

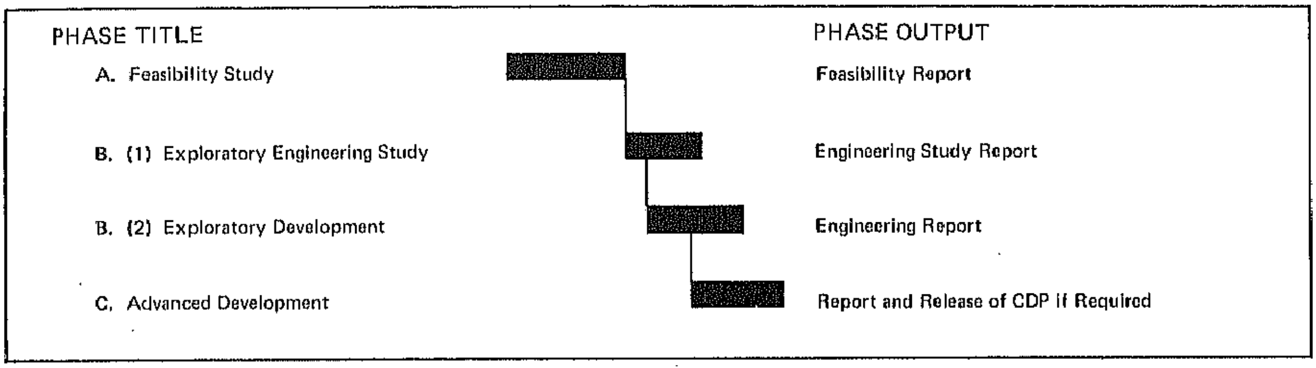
Before undertaking a major project, a feasibility study is made, particularly in the development of a new weapon or weapon system which depends on a combination of new principles, or which may satisfy a new tactical need.

This is mostly a paper study, with as little experimenting and testing as necessary. Its aim is to determine two things—is the weapon or system feasible, and is it desirable?

The proposed weapon or system is assessed at a reasonable level of confidence to determine if its characteristics are attainable within acceptable limits.

The value of the target (or the

NOL Phase Plan: Part I



NOL Phase Plan: Part II

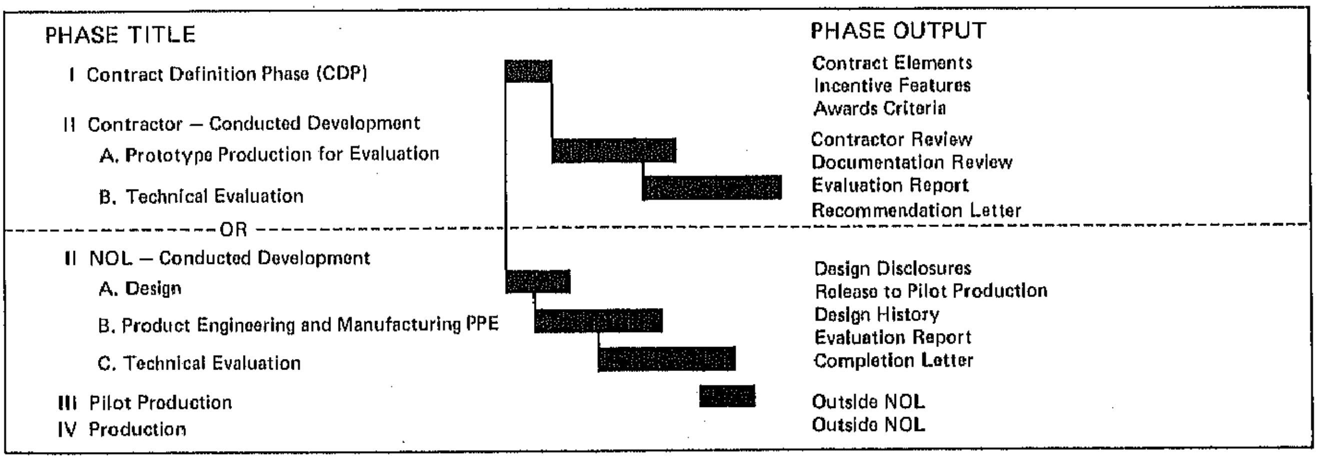


Figure 1

magnitude of the threat) should be compatible with the effort required to develop and deploy the proposed weapon. It should furnish a capability not now in existence or should do a better job than some existing weapon, with sufficient cost-effectiveness margin on this preliminary study to indicate an engineering study has reasonable prospects for a worthwhile pay-off.

The exploratory study and development, which is divided into two parts, takes the study of the project into greater depth.

The exploratory engineering study is a follow-on of the feasibility study and has as its purpose to:

• Make a fine-grain assessment of the key problems highlighted in the feasibility study, and to devise technical approaches for the solution.

• Establish in some detail a proposed weapon profile or performance envelope.

• Put tradeoff and cost-effectiveness studies of the feasibility study on a more quantitative footing in the light of the first two aspects of the exploratory engineering study.

• Formulate a detailed plan for the exploratory and/or advanced development which must be conducted to find solutions to the key problems prior to engineering or operational system development.

Exploratory development is typically composed of analytical studies, preliminary designs, and laboratory and field demonstration (often on a scaled basis) of the feasibility of tactical usefulness of a system. Hardware development extends only to the breadboard or experimental model stage.

For major systems, advanced development is conducted, with production of engineering prototype models and full or realistic scale testing in all key areas.

The results of the exploratory and advanced development phases are submitted to the Chief of Naval Operations in a report package, giving the elements needed to proceed with the contract definition phase.

From this information it will be determined whether development of the project will be conducted by NOL or by contract. If by contract, and in certain cases if by NOL, the project goes through a contract definition phase, in which a formal proposal is prepared by the contractor (or NOL if performing the development).

The contract definition phase is the usual entry point for a contractor into the project. However, exploratory or advanced development can be performed with contract assistance. If this is the case, NOL serves only as a consultant to the contractor in the contract definition phase, whereas normally NOL monitors the contractor output during this phase.

When the project gets to the development phase, it is expected that there will be little change in the objective specifications for the weapon characteristics.

For contractor-conducted development, NOL provides contract monitoring by reviewing:

• Technical approach and development progress.

• Performance for pay-off.

• Design documentation.

• Assembly and operation publications.

NOL also serves as trouble shooter, and normally is responsible for technical evaluation of the prototype.

It is essential that when the laboratory is assigned monitor, troubleshooter, or technical evaluation responsibilities, the contract with the developing contractor must be explicit in detail as to the laboratory's functions in order to avoid the charge of interference. Likewise, hardware requirements to carry out the laboratory's plan for technical evaluation should be clearly written into the contract.

Even when the development is carried out in-house by NOL, contract assistance is still usually required. Contracts for component or module development are awarded and technically directed by NOL.

Proof of the pudding is in the eating. After development has been completed, prototypes need to be evaluated. Whether NOL or the contractor has performed the development, NOL prepares the plan and conducts the technical evaluation.

Contracts for technical evaluation of hardware are awarded by NOL and receive NOL technical direction. Contracts for prototype production for evaluation may or may not be awarded to the same contractors used for the development.

Having passed NOL technical evaluation, the project is released for pilot production. NOL prepares a report and the release letter to the sponsor.

Technical data (drawings, specifications, quality assurance provisions, etc.) are prepared by NOL or by contract at the discretion of the laboratory. These documents are reviewed for product engineering, technical completeness, and accuracy and soundness of design. Publications covering the weapon description, assembly, test and checkout, operational use, etc., are prepared by NOL or by contract under NOL direction. This data is available to the pilot production and production contractors.

Project Responsibilities

Who is responsible for seeing that a project runs smoothly, is finished on time, and that the hardware functions as it should and meets all requirements?

Under NOL's present functional organization, one segment of the laboratory is expected to contribute the major effort in the development of a project. It is named the "lead segment," and its chief is responsible for seeing that the project is carried out.

However, in the case of major projects requiring effort from more than one of the discipline areas, it is essential that coordination be effected between the areas. For such a project a full-time staff assistant, or project manager, is assigned to the lead segment. He serves as the focal point in the laboratory for the project, and coordinates the project internally and externally. He is the laboratory's official spokesman and the contact for contractors and organizations outside Navy.

It is the project manager who charts the course of the project, making all plans of action and approach, and budgeting for personnel needs. He is responsible for preparing recommendations for release of the project to the laboratory management when the time comes for contract development or production work. He is, therefore, the man most closely in

(*Continued on page 29.*)

Risk Analysis

John D. Hwang
James L. Arnett

On July 31, 1969, Deputy Secretary of Defense David Packard sent a memorandum to the Secretaries of the Military Departments, highlighting major problems in weapon system acquisition and outlining current administration policy with respect to improvements.

The Army action plan to implement Secretary Packard's guidance extended the improvement program to the entire materiel acquisition cycle, and addressed overall program management. The largest areas of responsibility were under the Army Materiel Command (AMC), which devised a program called "Program for the Refinement of the Materiel Acquisition Process" (PROMAP-70). PROMAP-70 is being directed by Major General Paul A. Feyereisen, AMC's Deputy Commanding General for Materiel Acquisition. [See article, "PROMAP-70," by Major General Feyereisen, *Defense Industry Bulletin*, August 1970, page 18.]

Two of the tasks identified under PROMAP-70 as needing improvement were analysis of technical risk and cost estimating.

The following two articles discuss these subjects as they are being addressed under the program.

Analysis of risk is not new to the military services. However, the formal presentation of an in-depth study called a risk analysis *is* new. The latter is now a way of life for project managers in the Army Materiel Command (AMC).

Analysis of technical risk is one of the tasks of AMC's PROMAP-70 program. The objective of this task is to improve the analysis of technical risk so that cost growth does not result from prolonged development and from changes required to overcome technical problems. This objective is achieved by:

- Prototype demonstrations.
- Technical audits.
- Back-up development of high-risk components.

A necessary prerequisite to the developing of a capability to analyze technical risk was initiation of a training program. This task was assigned to the Army Logistics Management Center (ALMC) at Fort Lee, Va.

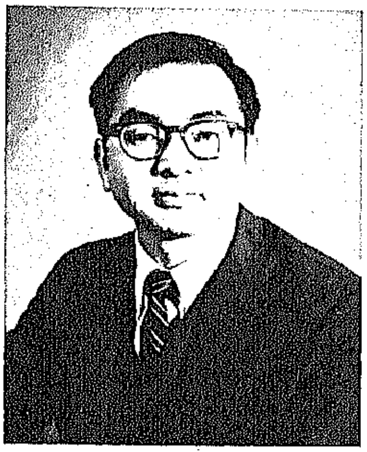
The scope of the effort that is being made to educate certain people in techniques and ways of doing risk analysis is broad. A logical question might be, why so much emphasis on this particular area, when there are so many other areas in logistics where attention is required? The answer to this question is quite involved.

To start with, proper executive decisions in any field require that the best possible information be provided the decision maker. However, in the case of a decision on a major weapon system, the requirement is significantly more stringent, in that the fate of the nation could well depend upon the outcome. Further, economic considerations also have great impact. Waste in Government has always been deplored. But, under present conditions, with large investments in heavy weapon systems and increasing requirements in the public sector, public reaction to military spending is such that no effort must be spared in ensuring that we get the greatest value for each defense dollar spent. Risk analysis is one tool which, when used correctly, can provide necessary information for decision making under such conditions.

What is the nature of this tool and is it new? Well, for some time the Defense Department has emphasized the use of quantitative methods in the process of executive decision making. By now, this movement has reached most levels of management in the military services. The most fashionable name for these techniques for the past few years has been *systems analysis*. For example, Alain Enthoven, one of the leaders in systems analysis under former Secretary of Defense McNamara, stated in *A Modern Design for Defense Decision** that systems analysis analyzes alternative objectives and explores their implications.

It is, therefore, clear that *risk* analysis and *systems* analysis are

** Alain C. Enthoven, "Operations Research at the National Policy Level," in* A Modern Design for Defense Decision, A McNamara-Hitch-Enthoven Anthology, *edited by Samuel A. Tucker (Washington, D. C., Industrial College of the Armed Forces, 1966).*



John D. Hwang is a research mathematician in the Systems Analysis Directorate, Army Weapons Command, Rock Island, Ill. Previously he served as special assistant to the Deputy Commanding General, AMC. He has also worked as a research engineer for several state and Federal agencies. He holds a B. E. E. degree from the University of California, Berkeley, and an M. S. in applied mathematics and Ph.D. in mathematics and systems engineering from Oregon State University.

very similar. If not the same family, they are at least the same tribe. There are some basic differences, but they are more related to techniques and methodology than to the purpose of the analysis. In fact, one could be considered as a subset of the other. The choice as to which is which would depend on the viewpoint of the evaluator. The discussion in this article will indicate how risk analysis has a close affinity to systems analysis and that it adds a new dimension to the acquisition process.

With the constant need to make management decisions on some quantified basis, emphasis on systems analysis in DOD began the
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budgeting. Planning involves cost-effectiveness analysis. Heavy reliance has been placed on systems analysis in the consideration of questions such as how much is enough, how should resources be allocated, and what tradeoffs among doctrine, weapons, equipment, etc., are feasible in the achieving of defense posture. All in all, systems analysis has been denoted as "quantified common sense" and used to provide "synthetic experience." Systems analysis/systems engineering can be defined as an explicit logical examination of alternatives by estimating and comparing the impact of each alternative on the cost and/or effectiveness of a given system without violating exogeneous constraints imposed on the system under study. One school of thought juxtaposes systems analysis and system engineering by establishing system performance objectives versus design criteria for system elements.

A significant part of the activities of DOD involves weapons development and production, or as we know it, the weapon systems acquisition process. This process includes four phases: concept formulation; contract definition; research, development, test, and evaluation; and production. It emphasizes the flow of decisions and activities, including actions, reactions, and interactions of government agencies and defense contractors. Decision analyses are required at all echelons of the defense organization regarding factors that affect the cost, time of availability, and performance of weapon programs.

A familiarity with basic terms is a prerequisite to the understanding of any subject, and decision analysis and acquisition management are no exception. For example, a weapon system is defined as a composite of equipments such as an aircraft, a radar unit, or a reconnaissance satellite with supporting gear, any one of which may be employed as entity to accomplish a military mission, such as offsetting a threat of potential advances of hostile bombers to our defense territories. An alternative definition of a weapon system is a set of potential military capabilities. The ability of a weapon system to perform a mission is described in terms of three quantities or dimensions: cost, time, and performance.

Cost reflects the resource commitments required to attack a specific level of potential enemy capability. Time denotes the period during which the weapon system is available for military operations, thereby determining the system's effectiveness relative to the military environment within which it operates. Finally, performance reflects a weapon system's technical quality in terms of system characteristics such as mobility, firepower, communication, and reliability. Reliability is further defined as the probability that the system can sustain its technical performance potential.

A weapon system program decision is defined as the decision to undertake and commit resources to the development of a specific weapon system. A multiplicity of technical, military, financial, and scheduling decisions determines the course of a

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typical weapon program. In actual program decisions, uncertainties are very real, and sometimes determining, complications. A closer definition would state that a weapon system program decision is a decision made under uncertainties much greater than normally encountered.

In defining acquisition management, we observe first that management *per se* is the process of converting information into action, while *acquisition* management constitutes an information feedback loop.

Acquisition management is a complex, multi-loop and interconnected system. Decisions are made at multiple points throughout the system, with each resulting action generating information that may be used at several but not all decision points. This structure of cascaded and interconnected information-feedback loops, when taken together, constitutes the management process. The interlocking network of information channels emerges at various points to control physical processes. Every action point in the management network is backed up by a local decision point whose information sources reach into other parts of the organization, and the surrounding environment.

A weapon system program decision involves the interrelationship of four fundamental elements: external threat, cost, state of the art, and time. The existence of an external threat is the *raison d'être* for weapons development. Cost enters into the program decision as a constraint. The state of the art constitutes a further constraint upon a nation's ability to deal with the external threat, at any particular point in time. As time passes, increases in the nation's stock of knowledge can be expected to offset to some extent the prior inability to deal with the external threat. The interaction between time, the growth of technical knowledge, and the external threat is therefore significant.

Historically, it has been imperative to exploit quickly all significant advances in the state of the art, in order to maintain the qualitative superiority, or at least parity, of the weapons inventory. This quickness implies the decision to begin development after technical feasibility is predicted, or at some time soon thereafter. Development lead time (the time interval between decision to begin development and ensuing operational availability of that weapon) is then dependent upon the amount of resources allocated to the development effort.

Past problems in cost growth, schedule slippage, and degradation of performance during the course of the weapon system acquisition process led to a search for a way to assess the probability of program success, and to control program problems. This assessment of program success constitutes the basis for the *risk analysis* of a program or project.

Uncertainties exist and affect the three dimensions of cost, time, and performance. A risk analysis is merely an extension of systems analysis to determine tradeoffs among these three dimensions, except that a fourth dimension of *risk* is introduced. This latter factor is used as a common measure to integrate the three dimensions. Hence, risk can be defined as the probability that the weapon system will fail in at least one of the following ways:

- Achieving the specified performance.
- Meeting the time constraint.
- Meeting the cost constraint.

Risk analysis can thus be envisaged as the *systems analysis of risk*.

As the basic objective of risk analysis is to create a quantitative and experimental laboratory to study the probability of program success, the general methodology for a risk analysis is quite similar to the steps involved in systems analysis, systems engineering, or industrial dynamics. The steps include:

- Identify objective.
- State the alternatives.
- Collect the data.
- Construct the model.
- Simulate.
- Validate the model.
- Obtain the criteria and establish trends.

Under the general methodology, the basic scheme for risk analysis is shown in Figure 1. We begin with the identification of the levels and details of the analysis. Next, all system candidates under consideration are noted. We detail out all uncertainties which could affect the three dimensions. We then collect data which are normally in two forms: objective—available data from testing, data bank, or previous studies; subjective—judgmental values ob-

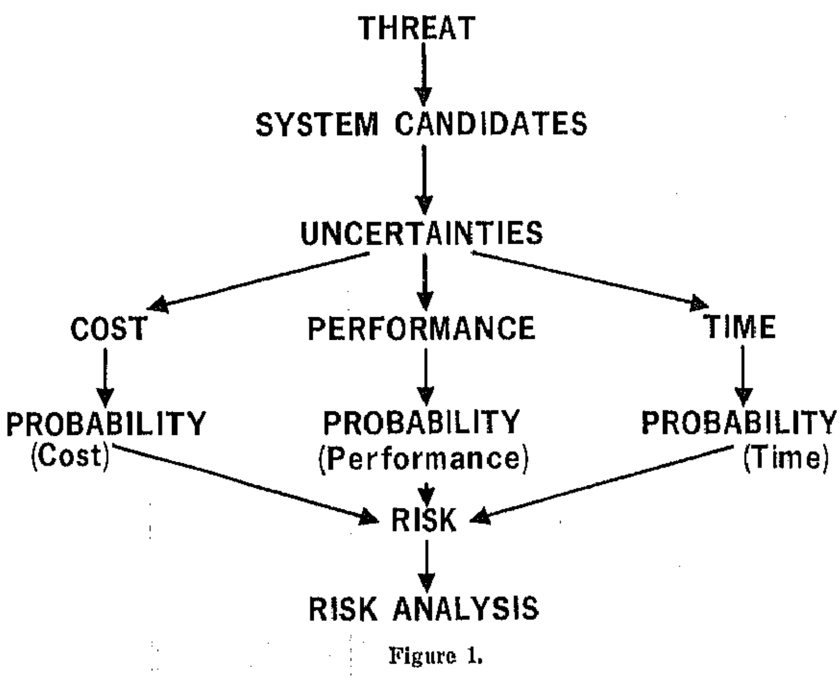

Figure 1.

tained from experts in the field under consideration.

It is now necessary to obtain probability distributions of performance, cost and time to completion and to construct the model to combine the probability values to calculate risk for each set of values of cost, time, and performance. It is also necessary to compute tradeoffs among these factors from simulations, to obtain criteria and trends as recommendations for decision analysis. Furthermore, sensitive elements or parameters and high risk areas are identified so that those critical areas are carefully monitored. Unfortunately, the necessary validation phase may not be possible until such time as actual test data are generated, or at regular update intervals.

In 1969, the Aerospace Industries Association (AIA) initiated a massive effort to uncover the problem of relating uncertainties in weapon system development. In identifying the essential technical steps, AIA found that there has been much similarity in the evolution of programs through uncertainties. Uncertainties fall into two main categories: the things you know you don't know at the start of the program, and things you don't know you don't know. Thus, we have *known-unknowns* for which allowances can be made and *unknown-unknowns* (unk-unks) for which one is unable to plan. Ideally, of course, we should quantify each uncertainty.

In these days of stringent budgetary restrictions, it is necessary that we ask ourselves whether or not resources devoted to risk analysis contribute to improved acquisition management. The answer is that significant payoffs include identification of high risk areas, so additional studies can bridge these gaps in the decision-making process, as well as enabling us to evaluate the sensitive and critical parameters which must be most carefully monitored. One added fallout benefit of risk analysis is to train all acquisition management personnel to become more conscious of system risk. Appreciation of risk by all levels of acquisition personnel should increase the probability of project success by contributing to the control of cost growth, schedule slippages, and degradation of performance. Finally, the quality of individual risk analyses will improve as the subjective type data provided by enlightened acquisition personnel improves.

Cost Estimating Techniques for Systems Acquisition

Major Paul R. Herholz Jr, USA

Under PROMAP-70, a profile study was made of the Army Materiel Command's capability for cost estimating and cost analysis. The results of the study evidenced the need for additional personnel, cost data centers in each commodity command, and formal training of personnel involved in cost estimating and analysis.

The Army Logistics Management Center (ALMC) was tasked to develop several new courses of instruction to assist in the accomplishment of specific tasks included in PROMAP-70. The first requirement was a course in life-cycle cost estimating.

This article introduces some cost estimating concepts taught Army Materiel Command (AMC) military and civilian cost estimators at ALMC.

Estimating Methods

Research in the field of cost estimating determined that, although numerous variations exist, there are basically three methods used for cost estimation—industrial engineering, analogy, and statistics. However, mention must be made of a fourth factor, the use of expert opinion. This quality is an essential element in any approach to the cost estimation of complex materiel systems.

Research indicated that quantitative methods, *i.e.*, statistical and some operations research techniques, should be emphasized in AMC cost estimating and analysis. It became evident, however, that the qualitative or subjective factors which influence a

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system's cost should also be considered. Regardless of the quantitative technique used, it is not possible to predict future events—in this case, cost—with certainty. Knowledge of the qualitative factors involved is essential to a basic understanding of the scope and complexity of the cost estimating problem. In addition, this knowledge assists an estimator in judging the validity of his analytical estimates. As a result, the cost estimators must consider both the quantitative techniques and the qualitative factors involved in predicting the life-cycle cost of a system.

Awareness of several qualitative factors is necessary for a well rounded understanding of the cost estimating problem. These include technical knowledge of those procurement policies, procedures, and techniques which influence a system's cost. AMC cost estimators are given information relevant to cost from the areas of contract definition and source selection, pricing policy and technique, contract pricing arrangements, negotiation, cost reduction, and the "should cost" concept.

Basic Assumption

The basic premise of all the techniques is that a cost estimate can be developed formally on the assumption that experience is a reliable guide to the future. In the simplest case the guidance is clear, such as the cost of off-the-shelf commercial items. At a slightly more sophisticated level, average costs can be calculated and used as factors to estimate, *e.g.*, the cost to drive a tracked vehicle a mile or fly a helicopter for an hour. A great deal of estimating is of this general type —the relationship between past experience and future expectation is fairly obvious.

The problems which are of most concern, however, are those in which the relationship between the past and the future is unclear, because the new item differs in some significant way from its predecessors. The challenge to AMC and industry cost estimators is to project from the known to the unknown, and to use experience gained on existing equipment to predict the cost of equipment of the next generation.

The statistical technique of regression analysis can often be used, when relevant data is available, to predict the costs of components of a new system and, in some cases, the entire hardware cost. The technique can be used when it is felt that a relationship exists between a physical characteristic of the component or system and the cost of the component or system.

Figure 1 shows an example of the basic concept of regression analysis. In the example, the relationship between the independent variable (vehicle gross weight) and the dependent variable (POL cost per mile) is linear. Functional relationships, such as the one illustrated, are called cost estimating relationships. As an illustration of how this particular example would be used, suppose that we were planning to build a 10,000-pound truck. Assume that we hadn't done this before, but that the new vehicle is within the range of our experience as far as weight and POL cost are concerned. A rough estimate of the POL cost per mile could be read directly from the graph. A more accurate estimate could be obtained by using the formula for the regression line (trend line) which in the linear case is of the form $Y = a + bx$. For this particular example the formula is $Y = .93 + .000079$ (gross weight). By substituting 10,000 for X, and solving the equation, we arrive at our estimated POL cost of $0.0172 per mile for our new vehicle.

A complete regression analysis is much more complicated than indicated by the brief discussion presented thus far, but is standard subject matter in statistical literature.

The principles involved in the simplest form of regression analysis, *i.e.*, where the relationship between cost and some other variable is linear, can be expanded to explain the case where the relationship between cost and an independent variable is not linear (curvi-linear regression); and to explain the case where more than one independent variable is used to explain cost (multiple regression). As an example of this last case, and referring to our previous example of vehicle weight and POL cost, we may find that weight does not adequately explain POL cost per mile. We then search for additional explanatory variables. One possibility might be engine horsepower. If we wish to use both

Example: Simple Linear Regression

Petroleum, Oil and Lubricants (POL) Cost Per Mile versus Vehicle Gross Weight for Selected Vehicles

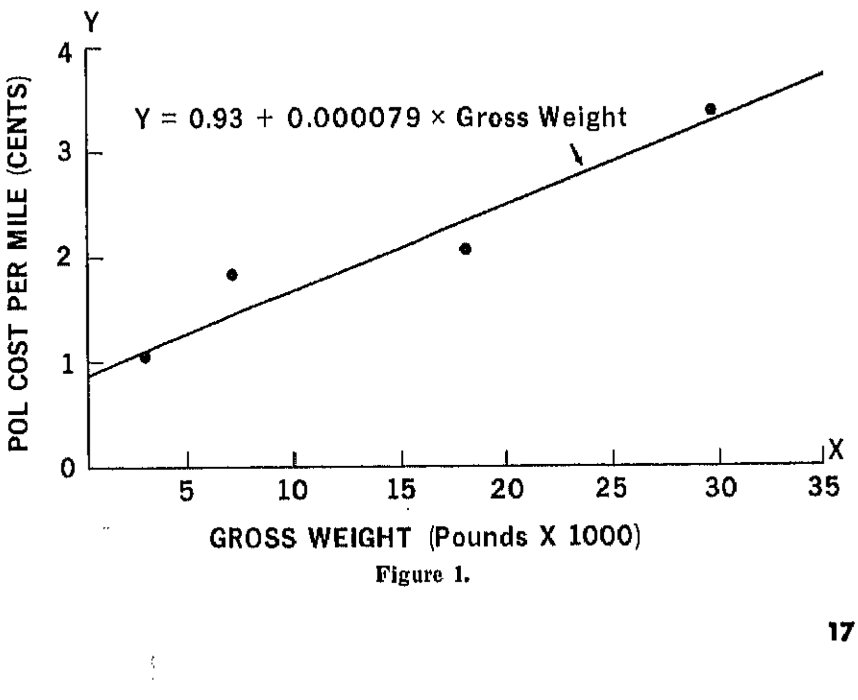

Figure 1.

weight and horsepower, our model is of the form

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2,$$

where X_1 is vehicle weight and X_2 is vehicle horsepower. The solution for this particular example is

$$Y = 1.4 + .000137 \text{ (gross weight)} + .011 \text{ (horsepower)}.$$

This model (or any other model) can be tested to determine if a statistically significant relationship exists between cost and the independent (explanatory) variables used in the model.

Curvi-linear and multiple regression problems can become extremely difficult to handle analytically if a complex model is established. Since the basic principles of the analysis remain the same regardless of the particular model used, our approach in the course is to ensure that the AMC cost estimator understands what he is doing and then show him how to use a computer to perform the mathematical portion of the analysis.

The basic problem for the estimator, then, is to find one or more variables and the functional relationship which explains the cost of his system or components of his system.

Regression analysis is not, however, a panacea for cost estimating. The models established must be based upon a logical relationship between the independent variable(s) and cost. In addition, accurate historical data must be available. Unfortunately, accurate relevant data is not always available. This is particularly true when the system under development represents significant state-of-the-art advancements.

In addition to its role as a tool for analyzing cost estimating relationships, regression analysis is an integral part of learning curve theory. The learning process is a phenomenon that exists in many industries; empirical data and controlled tests have verified its existence. The basic hypothesis of learning curve theory states that each time the total quantity of items produced is doubled, the cost per unit is reduced to a constant percentage of its previous cost. Alternative forms of the theory consider the unit cost of producing an item at a given quantity or the average cost of producing all items up to a given quantity. For example, if the cost of producing the 100th unit of an item is 90 percent of the cost of producing the 50th unit, and if the cost of producing the 200th unit is 90 percent of the cost of the 100th unit, and so on, the production process is said to follow a 90 percent unit learning curve. If the average cost of producing all 200 units is 90 percent of the average cost of producing the first 100 units, the process follows a 90 percent cumulative average learning curve.

The use of learning curve theory to predict unit cost is particularly appropriate when non-standard items are involved and when the direct labor requirement is a substantial portion of the production cost.*

Industrial Engineering Technique

The industrial engineering technique is also considered to be one of the principal approaches to cost estimating. Estimating by industrial engineering procedures can be broadly defined as the examination of separate elements of work at a low level of detail and the summation of the many detailed estimates into a total cost. The estimator begins with a set of drawings and determines each engineering task, tool requirements, production operation, and the labor and material involved. The name and number of the operations and the machines that will be used must be determined, together with estimates of set up and operating time and labor cost. Standard set up and operating costs are used if they exist. If standards have not been established, a study is made to determine the most efficient method of performing each operation.

The detail estimator works from sketches or word descriptions of some item that in many cases has not been completely designed. As such, he suffers from the same disadvantages as do all other estimators before an item has been produced. Costs can be assigned only to work that is known. An attempt is sometimes made to apply factors to a detailed estimate for such costs as rework, planning time, quality control, manufacturing research, etc. The factoring process has the disadvantage that small errors in the detailed estimate can result in large errors in the total.

Since a private firm usually has only information on its own products, much estimating in industry is based on analogy. Engineers and foremen may rely on analogies when making detailed estimates; in this case, analogy becomes part of the industrial engineering approach.

Industrial engineering estimating procedures require a considerable number of people and extensive data. The technique is costly and time consuming. In addition, it has been found that for many purposes the industrial engineering technique produces results that are less accurate than estimates made statistically. One reason is simply that the total often is greater than the sum of the parts. There will always be cases in which industrial engineering and/or analogy approaches are required, but in general statistical methods are more useful, whether the purpose is long-range planning or contract negotiation.

At Concept Formulation

The most difficult point of time in which to apply a quantitative approach to cost estimating is in the concept formulation stage of a new system. At this time, the least detailed information is known about the project. One technique that considers this problem utilizes network theory, a variation of PERT (Program Evaluation and Review Technique); subjective probability; and simulation. In the concept formulation stage, it is not always possible to identify all the activities necessary to complete the project. The technique taught at ALMC considers the fact that some activities are uncertain and provides a means to analyze the effect of tradeoffs when desired activities prove to be unfeasible. Empirical data may not be available for estimating the probability of success and cost for many activities involved in a new project. One is forced to use a Bayesian approach, *i.e.*, subjective probability estimates for such

* *See article, "Predicting Production Costs with Learning Costs," Wiley F. Patton,* Defense Industry Bulletin, *November 1969, page 5.*

activities. Since the value of the simulation for predicting a system's cost is proportional to the accuracy of the activity probability statements, it is of the greatest importance that the best information and professional judgment possible be used in the development of the activity probability statements. Empirical data should, of course, be used whenever possible.

Since the technique is based primarily on subjective probability, the results must be critically examined in conjunction with whatever additional information is available at the time. However, as a minimum, the technique reveals time and cost limits for any specific approach to project development. In addition, the procedure requires a systematic approach to planning the materiel system under consideration and analysis of expected areas of difficulty.

Sensitivity Analysis

A life-cycle cost estimate for a complex materiel system will contain a large number of cost factors. The accuracy of the cost estimates for some of the factors will have little effect on the accuracy of the total life-cycle cost estimate. However, the variability of other cost factors may greatly affect the total system cost estimate. The most important cost factors (in terms of effect on life-cycle cost) are identified by the use of a procedure called sensitivity analysis.

Sensitivity analysis in costing is basically the process of examining the cost factors in the system to which an optimistic and pessimistic cost estimate can be applied. The life-cycle cost study is then repeated, keeping every input the same as in the initial estimate except for one input which is given one of its limiting values. The change in the total cost estimate due to the change in the one input is obtained. This process is then repeated for both limits of each input to which limits were assigned. Sensitivity analysis results in a list of investigated inputs showing a ranking of inputs in order of their impact on total system cost. The majority of the validation effort should be applied to those factors identified as having the greatest effect on total system cost.

When the life-cycle cost estimate is completed, regardless of the technique used, an economic analysis of the estimate should be made. This analysis must include the time value of money in the form of an interest rate.

The process of discounting the cost of a system provides a means of comparing competing weapons or materiel systems from a standard cost base, *i.e.*, present value or current fiscal year dollars. Although many factors other than cost are considered in determining a preferred system, a comparison of discounted systems' costs is of considerable value in determining the cost effectiveness of each of the competing systems.

The major advantage of escalating a system's cost is to reveal the total life-cycle cost that will have occurred when the project has completed its life cycle. This information is valuable for fiscal planning. An additional benefit, assuming a fairly accurate rate of inflation is used, should be a reduction of cost growth criticism which occurs as a result of inflation and is sometimes confused with poor planning.

The net result of improved life-cycle cost estimates is a better factual base for intelligent management decisions. It is expected that application of these and other techniques taught at ALMC will result in improved cost estimating by both AMC and industry.

Containerization Program Given Product Management Status

The Army Materiel Command (AMC) has elevated its containerization program to product management status in an effort aimed at ultimate development of a totally integrated containerization system for Army-wide application.

Product management status is reserved for items of equipment or systems accorded special intensive management attention because of criticality of mission, urgency, complexity, or high level interest. Product manager is Colonel Raymond A. Cramer Jr., a transportation and supply distribution expert.

Reporting directly to the Commanding General, Army Materiel Command, the Product Manager for Container Systems has management responsibility for development of materiel and plans, as well as execution of life-cycle pilot operations in supply distribution.

Objectives of the program are:

- To develop a total systems concept, wholesale supply doctrine, plans for supply distribution operations and directive documentation.
- To develop, test, procure, and place into operation containerization systems, including related materials handling equipment, which will provide the Army with an effective and economic containerized logistic distribution capability.

The Army pioneered containerization with its all-steel CONEX (Container Express) fleet 18 years ago. This steel box, about 7 feet on a side, is used for consolidating into a unitized load many small packages. Since May 1969, the Army has had a fleet of leased units of the larger 20-by-8-by-8-foot size for overseas shipments. More recently, AMC successfully demonstrated containerized overseas shipment of ammunition. Efforts are now underway to establish a total containerized Ammunition Distribution System Army-wide.

A development and acquisition program for an Army-owned fleet of inter-modal containers conforming to U.S. and international standards is now in progress and the first production model from a procurement order of 6,700 is currently undergoing tests.

As the Army sees it, a universal containerized logistics distribution system with associated standardized materials handling equipment and documentation procedures can pave the way for "thru-put" supply from depots or factories directly to field units at savings in transportation costs, manpower and with increased efficiency in operations.

Industrial Personnel Security Clearance Review

William J. Scanlon

The Defense Department Industrial Security Clearance Review Office (ISCRO) was established pursuant to DOD Directive 5220.6, "Industrial Personnel Security Clearance Program," to administer the program prescribed by that directive. The office is a component of the Office of the Assistant Secretary of Defense (Administration) which, through the Deputy Assistant Secretary of Defense (Security Policy), provides overall policy guidance for the program. Those officials are responsible for the administration of the ISCRO, including the organization and composition of its various boards, field offices, and staff.

The primary function of ISCRO is to adjudicate the eligibility for security clearance of those persons (called applicants, regardless of whether they are, in fact, new applicants for clearance or persons for whom clearances already have been granted) whose eligibility has been questioned by the Defense Industrial Security Clearance Office (DISCO), a component of the Defense Supply Agency. The Defense Department Industrial Security Regulation places upon DISCO the responsibility for processing applications for industrial personnel security clearances. That includes responsibility for initiating appropriate investigations, reviewing the completed investigations, and issuing clearances (letters of consent) for those applicants whom DISCO determines to be eligible. Cases of those applicants whose eligibility for clearance DISCO questions are forwarded to ISCRO for adjudication.

It is important to note that, although DISCO is authorized to make final determinations favorable to applicants, it is not authorized to make final adverse determinations. Any case which, upon the basis of all available information, DISCO cannot determine favorably under the standard must be referred to ISCRO so that the case may be adjudicated in accordance with the procedures set out in DOD Directive 5220.6. As a practical matter, DISCO refers to ISCRO for adjudication all those cases containing apparently substantial information reflecting adversely upon the applicant's reliability, integrity, trustworthiness, or suitability for a position of trust. Those are the so-called "substantial derogatory information" cases.

All final determinations, whether made by DISCO or ISCRO, and whether in the applicant's favor or adverse to the applicants concerned, are made in accordance with the standard set out in Section V.A. of DOD Directive 5220.6. That section, which derives from Section 2 of Executive Order 10865 titled, "Safeguarding Classified Information Within Industry," reads:

> Access to classified information shall be granted or continued only to those individuals who have been determined eligible based upon a finding that to do so is clearly consistent with the national interest.

Section VI of the directive provides 21 specific criteria for guidance in application of the standard. However, it also provides that ISCRO need not be limited to those specific criteria in making determinations. On the contrary, the ultimate determination in any case must be an overall common sense one, based upon all the information which properly may be considered, including but not limited to, such factors as the gravity of the adverse information involved, its implications, its recency, etc.

William J. Scanlon is Director of the Office of Industrial Security Clearance Review, Office of the Assistant Secretary of Defense (Administration). Before Mr. Scanlon was appointed director in January 1966, he served in ISCRO successively as Security Advisor, Special Assistant to the Chief Department Counsel, and as a member of the old Central Review Board. He is a lawyer and was admitted to the Bar of the U. S. District Court for the District of Columbia in 1940.

The headquarters of ISCRO is in the Pentagon. ISCRO has field offices in New York (Eastern Field Office), Los Angeles (Western Field Office) and Arlington, Va. (Washington Field Office).

The office is composed of a director and an administrative staff; a Screening Board (two panels composed of three members each); five hearing examiners; an Appeal Board (one panel composed of three members); and Department Counsel (a Chief Department Counsel and eight associate or trial counsels).

The Director, the Screening Board, the Appeal Board, Chief Department Counsel and a portion of his professional staff, and the bulk of the administrative staff are located in the Pentagon headquarters of ISCRO. The Eastern and Western Field Offices each are staffed by two hearing examiners, two trial counsels, and two clerical employees; the Washington Field Office by one hearing examiner, one trial counsel and one clerical employee. In each field office, one of the trial counsels also functions as the administrative director of the office.

The flow of cases referred by DISCO to ISCRO is depicted in Figure 1.

A screening board determination in the applicant's favor is a final determination. In those cases, DISCO is directed to grant (or continue) a security clearance for the applicants concerned.

A screening board determination adverse to an applicant is not final. The applicant must be furnished a Statement of Reasons (SOR) prepared by the screening board setting out the basis for its determination. He has the right to submit a written answer to the SOR; an opportunity for a hearing before an examiner; and, ultimately, a right of appeal to the Appeal Board. However, should he fail to submit a timely answer to the SOR, he is denied clearance administratively, without further processing, and any existing clearance is revoked.

Should the applicant submit an answer to the SOR and request a hearing, his case is assigned to an examiner for hearing and determination. Every reasonable effort is made to hold the hearing at a place and time convenient to the applicant. Should the applicant submit an answer to the SOR and waive his opportunity for a hearing, his case is assigned to an examiner for determination upon the basis of all the available information, including the answer to the SOR and any supporting evidence the applicant may choose to submit.

Either the applicant or the Government (department counsel) may appeal the examiner's determination in which event the record in the case, including the examiner's determination, is referred to the Appeal Board for final determination. The Appeal Board sits only in the Pentagon. Appeals may be made by brief or by appearing personally before the Appeal Board to present oral argument. In the absence of timely appeal to the Appeal Board—10 days—the examiner's determination constitutes the final decision in the case.

Screening Board

The Screening Board is composed of civilian and military personnel. It is divided into two panels of three members each. Every case referred by DISCO is submitted to the Screening Board for review and determination. Either panel of the Screening Board may act upon a particular case. Screening Board determinations are made by majority vote of the panel to which the case is assigned by the Director of ISCRO.

The panel to which a case is assigned must make what is basically an "either/or" decision: either enter a determination in the applicant's favor, notwithstanding the information which caused DISCO to refer the case to ISCRO, in which event the determination is final and DISCO is directed to grant (or continue) clearance for the applicant; or enter a determination adverse to the applicant and prepare a Statement of Reasons (SOR) setting out the basis for that determination.

Case Flow

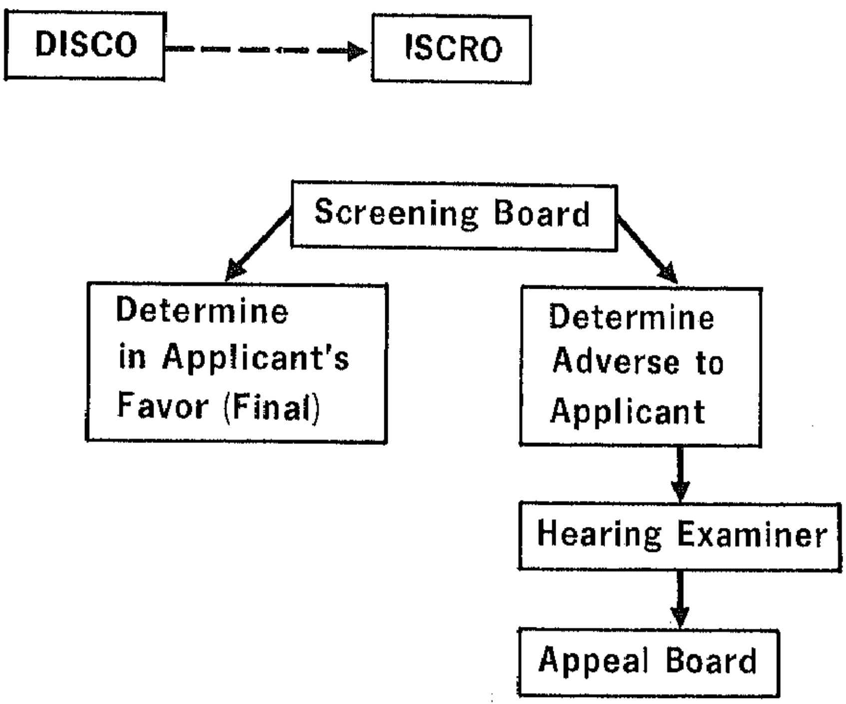

Figure 1.

There is an interim action available to the Screening Board in those cases in which it is not satisfied with the adequacy or clarity of the information available to it. It may request supplementation or clarification either by additional investigation, by interview with the applicant, by ordering a psychiatric evaluation of the applicant, or by other fact finding procedure such as written interrogatories. Ultimately, however, it must either render a determination in the applicant's favor which is final; or it must enter a determination adverse to the applicant, in which event it must prepare an SOR.

In a case in which the Screening Board's determination is adverse to the applicant, the applicant is informed thereof, is furnished a copy of the SOR, and is advised fully of the further procedures available to him. Those further procedures include the right to submit a written answer to the SOR; an opportunity for a hearing before an examiner; and, ultimately, a right of appeal to the Appeal Board. Should the applicant fail to submit a timely answer to the Statement of Reasons, he is denied clearance administratively, without further processing, and any existing clearance is revoked.

Hearing Examiner

Whenever an applicant replies to the SOR and elects not to request a hearing, the case is assigned to one of the field office examiners for determination based upon all available information, including the applicant's answer to SOR and any affidavits or factual information which the applicant may have furnished with it.

Whenever an applicant replies to the SOR and requests a hearing, a more involved procedure then comes into effect. The hearing is a most crucial stage of the adjudication of a security clearance case. The procedures incorporated in DOD Directive 5220.6 are an outgrowth of the Supreme Court decision in *Green v. McElroy* (1959), which held that, in the absence of explicit authorization from the President or Congress, DOD was not authorized to make a final denial or revocation of clearance by procedures which did not afford opportunity for confrontation and cross examination. The question of constitutional due process troubled the court very much, but by deciding the case on the issue of authority, the court postponed the constitutional question to another day. Nevertheless, the language of the court was very instructional. Accordingly, Executive Order 10865, dated Feb. 20, 1960, was issued to deal explicitly, among other things, with opportunity for cross examination. DOD Directive 5220.6, which was issued to implement the executive order, covers this matter in very specific detail and in a manner which assures due process.

Hearings are held before experienced hearing examiners who, to accommodate the applicants concerned, travel throughout the country. The Government is represented at each hearing by department counsel (trial counsel), who presents the government's case, cross-examines adverse witnesses, etc. The examiners and department counsel are qualified attorneys.

The applicant is entitled to be represented by counsel before the hearing examiner and, although it is not mandatory, most applicants do appear before the hearing examiner with legal counsel. The hearings are not subject to the Administrative Procedures Act, and strict rules of evidence are not applicable; however, the hearings in the security clearance program are conducted with much of the formality and professionalism of a court hearing, and rules of evidence normally followed in a court of law often are applied by the hearing examiners. One definite requirement which grew out of the Supreme Court's decision in the *Greene* case is that applicants must be afforded the opportunity to cross-examine their "accusers." The Defense Department may not, except as specified hereinafter, introduce a statement adverse to an applicant on a controverted issue unless the applicant is given the opportunity to cross-examine the person who furnished the adverse information. However, we are handicapped in this respect by not having the power of subpoena. Persons who have provided adverse information to investigators cannot be compelled to appear and testify at a hearing, and there have been cases in which they have refused.

The procedures set out in DOD Directive 5220.6, based upon the authority of Executive Order 10865, provide for two exceptions to the opportunity to cross-examine accusers, and only one of those exceptions actually has been invoked since issuance of the executive order in 1960. The first exception provides for the introduction of a certificate from the Attorney General to get into the hearing record adverse information furnished by a current confidential informant of the Federal Bureau of Investigation when, in the opinion of the Attorney General, it would be substantially harmful to the national interest to disclose the identity of the informant by bringing him forth as a witness. We have not yet found it necessary to utilize this exception.

The second exception permitting information or evidence to be received and considered by the hearing examiner without providing opportunity for cross-examination involves a situation in which the Assistant Secretary of Defense (Administration) personally certifies that the witness cannot appear at the hearing because of death, severe illness, or similar cause, or in which the Secretary of Defense determines that other "good and sufficient" cause exists for the witness not appearing. This latter exception has been used in only two cases.

There also is a saving clause in the DOD directive which permits the Secretary of Defense personally to order that the provisions of the directive, which require issuance of a Statement of Reasons, an administrative hearing, appeal, etc., shall be by-passed in a particular case whenever he determines personally that the provisions of the directive "cannot be invoked consistently with the national security." The latter extraordinary authority has never been exercised but is available should the need arise in a particular case. It might be invoked, at least theoretically, in a situation where for reasons of national security the

adverse information cannot be established at a hearing by a live witness or where for sound security reasons the Defense Department would not want to disclose the information which formed the basis for the action. This exception is designed to permit the Secretary of Defense to act summarily in a particular case which he personally has determined presents a very serious threat to the national interest, and in which the formal procedural requirements cannot reasonably be followed.

The hearing examiners make determinations which become final unless appealed within 10 days by either the applicant or department counsel.

The Appeal Board

The 3-man Appeal Board sits at the Pentagon, with the full-time duty of considering appeals either by applicants or by department counsel from determinations of examiners. All three members of this board are attorneys, and their deliberations are limited to the consideration of the case record created at the hearing level, together with briefs filed by the respective parties, and/or oral argument presented in formal sessions before the Appeal Board.

The Appeal Board's determinations are final, subject only to an appeal to the courts.

Department Counsel

The Chief Department Counsel and eight assistant department counsels are charged with representing the Defense Department before the hearing examiners and before the Appeal Board, and with assisting the Screening Board in cases pending before it. The five department counsels assigned to the field offices have the primary function of representing the Government at hearings before examiners. Those assigned to ISCRO headquarters in the Pentagon are charged primarily with reviewing cases prior to the issuance of SORs, preparing cases for hearing once answers to the SORs have been received, and representing the Government in cases before the Appeal Board.

The Office of Department Counsel also gives legal advice to the Deputy Assistant Secretary of Defense (Security Policy) and prepares litigation reports for submission to the Department of Justice whenever suit is filed against the Secretary of Defense, arising out of an industrial security clearance case.

As mentioned early in the article, the Defense Industrial Security Clearance Office (DISCO) is authorized to make final determinations favorable to applicants for security clearance; it is not authorized to make final adverse determinations. When DISCO cannot make a favorable determination under the standard, the case must be referred to the DOD Industrial Security Clearance Review Office (ISCRO) for adjudication.

Thousands of clearance applications are processed annually by DISCO without development of apparently substantial adverse information. Those applications are processed to final determination and clearances granted by DISCO without referral to ISCRO for adjudication. Of the 261,649 personnel security clearance applications processed by DISCO in FY 1969, only 944 (less than 0.4 percent of the total) required referral to ISCRO for adjudication in accordance with the procedures set out in DOD Directive 5220.6. Clearances were granted in the 99.6 percent of applications processed upon the basis of final determination by DISCO that it was clearly consistent with the national interest to do so.

DOD Reduces Barriers to Technology Transfer

Secretary of Defense Melvin R. Laird has taken new actions to accelerate achievement of DOD's objective to make more information available to the general public and the technical community, consistent with national security.

The first action taken was to see that only that defense technology which clearly needs to be protected in the national interest has a security classification, and that such security classifications be retained for the shortest possible time. In the past, major emphasis for classification had been placed only on the possible benefit of the information to potential enemies without any consideration towards the benefit it may give to the U.S. industrial and domestic community. Now, both reasons must be considered in making the classification decision.

DOD also has initiated a number of programs designed to declassify existing technological information which no longer needs to be classified. This will reduce or avoid costs within DOD and industry by eliminating a significant amount of security maintenance expenses. It also will make many previously classified technical reports available to the scientific, academic and technical community.

The final action is virtual elimination of the practice of limiting distribution of technical reports, whether classified or unclassified, to only selected segments of the Government, such as small project or special interest groups. Before this decision, at least 56 percent of the approximately 45,000 DOD technical documents prepared each year were withheld from the National Technical Information Service (NTIS), the primary outlet for DOD technical information to the public. At least 17 percent are withheld for security classification reasons, while some 39 percent are unclassified but withheld because the originator had placed a limitation on the report's distribution.

AIM-82 Cancelled

The Air Force has cancelled further efforts to develop the AIM-82 short range tactical air-to-air missile. Replacing it as the initial air-to-air missile for the F-15 air superiority fighter will be an advanced version of the Navy's AIM-9H Sidewinder. The advanced Sidewinder will also serve as an improved performance missile for current fighters.

The cancellation is the result of Air Force-Navy discussions on the development of a single missile for joint service and multiple aircraft use.

Progress in Controlling Management Systems

David H. Moran

So much criticism has been directed toward the Defense Department for acquisition management problems that we must take stock as to what corrective measures are being executed. The Defense Department has had a very comprehensive effort to control management systems underway since 1966. It has a number of built-in "fixes" for DOD acquisition management problems. The program is based on three steps:

- Collect all management systems used by DOD in a list useful for procurement and management people. Continually police the list, purging it of ineffective systems and eliminating redundancies.
- Control the development of new management systems and control the revision of existing management systems.
- Use effective criteria for selecting management systems for application on contract.

Progress

This joint government-industry project to restrain the proliferation of management systems was started as the result of efforts of both DOD and industry. The Assistant Secretary of Defense (Comptroller) expressed concern with this problem in a speech delivered March 3, 1966. Industry's concern was expressed in the Systems Management Analysis report, presented to the Defense Industry Advisory Council in June 1966. As a result of these and other events, *e.g.*, the publication of DOD Directive 7000.1, the Assistant Secretary of Defense (Comptroller) was charged with responsibility to discipline the generation and application of management systems. The Directorate for Management Systems Control, now a division, was established within the Office of the Assistant Secretary of Defense (Comptroller).

The accomplishments of the resulting Management Systems Control Program are tangible, effective tools, but the most difficult straits lie in the year ahead.

The accomplishments are:

- Publication of DOD Instruction (DODI) 7000.6, "The Development of Management Control Systems for Use in the Acquisition Process," in June 1968.
- Publication of DOD Instruction 7000.7, "The Selection and Application of Management Control Systems in the Acquisition Process," in June 1968.
- Compilation, publication and purging of the Management Control Systems List. The first interim edition was published in October 1968. The latest and authorized edition was published in July 1970. DOD Manual 7000.6M, the Authorized Management Control Systems List (AMCSL) is a list of approved management systems which conform to the standards for effective management systems found in DODI 7000.6. The AMCSL is, according to the Armed Services Procurement Regulation (ASPR), paragraph 1-331, the only valid source of management systems to levy on DOD contractors for contracts over $1 million. Special approval by the Service Secretaries is necessary for application of management systems not on the list.

With the publication of the AMCSL, a major milestone has been met in the program to control management systems.

Choosing a System

Let's discuss the problems of Service implementation, which fall squarely on the shoulders of the program managers and procurement people.

David H. Moran is Director, Management Systems Control, Office of the Assistant Secretary of Defense (Comptroller). His experience includes mechanical design, test engineering, production engineering, manufacturing, project management and management consulting. He was vice president and director of engineering, John I. Thompson and Co., Washington, D.C., before joining DOD. He holds a bachelor of science in engineering from University of California at Berkeley.

Of the two DOD instructions, DODI 7000.7, which is concerned with selection and application of management systems, has direct impact at the field level. DODI 7000.6 impacts at the command and headquarters level, because it is at those levels that most new management systems or revisions are generated.

Management systems are to be chosen from the AMCSL according to procedures laid down by ASPR. Emphasis is placed on the management plan. That is, the program manager designee must ask himself, "For prudent control over the resources to be expended, what management techniques or systems do I need? What do I need for management of expenditures and cost control? What do I need to manage and control schedule? What do I need to exercise control over technical performance?"

Obviously, the type of contract ultimately used has a bearing on the management systems to be used. Fixed price contracts by definition preclude or limit the need for reporting of costs. However, fixed price contracts are often opened up for changes. If this is suspected to occur, provision for unit cost control is in order from the outset.

Program managers, when made aware of the Management Systems Control Program, rightly ask, "What will it do for me?" The answer is, "Plenty!" This program represents a *revival* of good management practices. Past experience has shown that programs in trouble do not usually have a cohesive management plan. A search through the contract instrument of a program in trouble invariably discloses a disjointed approach to management. There is a clause here, a report requirement there, and a reference to an appendix farther on. In the past, there has been no single place in the contract instrument where the management system requirements were brought together to show a complete management picture.

A Management Control Systems Summary List (DD Form 1660) is now required as a part of the contract. This summary contains a list of management systems chosen from the AMCSL to implement the management plan, as well as statements regarding tailoring and specific contractor management systems acceptable in lieu of the authorized system.

DODI 7000.7 encourages the use of contractor systems acceptable to the criteria of DODI 7000.6. The authorized system called out on the DD Form 1660 is used as a model of specification where contractor systems are considered. Acceptable contractor systems are entered on the DD Form 1660 with the statement that they are accepted in lieu of the authorized system.

DODI 7000.7 encourages tailoring which utilizes only those portions of the management systems required for prudent resource stewardship. Additional requirements tacked on to approved systems are specifically forbidden without going through the approved rigors of the development instruction, DODI 7000.6, or without obtaining one-time approval from the Service Secretary.

The Management Systems Control Program was designed to dovetail with the consolidation of the several Service Authorized Data Lists. Cross references to management systems are provided in the Data Item Description (DD Form 1664). Also, this program naturally conforms with policy guidance from the Deputy Secretary of Defense to improve management and reporting to the Services.

Education of field level management and procurement personnel is the first priority at present. This is best accomplished by attacking specific problems encountered in management planning, as well as in writing both requests for proposal (RFP) and the contract instrument itself. The focus is on *more* and *better* management planning *prior* to committing the Defense Department to a contract.

Potential Benefit

The potential payoff of the Management Systems Control Program is big.

- There is emphasis on management planning as a requisite for choosing appropriate management systems from the AMCSL. Any lack of management planning shows up as a void or overlap on the Management Control Systems Summary List, DD Form 1660, in both the RFP and the contract. Reviewers of contract papers prior to signing can begin their check on adequacy by looking for appropriate schedule controls, cost controls and technical performance controls listed on the DD Form 1660.
- There is emphasis on tailoring specific management systems to fit the application. Again, the DD Form 1660 provides the reference to the page in the RFP or contract where specific provisions of the management system are tailored.
- There is emphasis on using effective contractor systems when they comply with the system called for on the DD Form 1660. In this, the AMCSL reference is used as a criterion to which the contractor system must conform satisfactorily. Again, the DD Form 1660 provides for the statement that a certain contractor system, properly identified, described and dated, is acceptable in lieu of a Government specified system.
- For the first time, data products (reports and forms) are required to be related to management systems from which they stem. This is done by a cross reference to the Contract Data Requirement List (DD Form 1423) and the related data product.

Conclusion

This program has a solid foundation and is just now being followed to the extent that its impact is being felt by managers and procurement people. The number of new management systems developed last year was minimal.

New major weapon buys now include DD Form 1660 in the RFPs and contracts. This brings management provisions into focus for those responsible to determine their adequacy, lacks, or potential dangers before contract signing.

The authorized list of management systems for use on contract numbers 170 systems. In addition, there are approximately 90 management systems unique to certain programs. These do not conform to the DODI 7000.6 standards for management systems but are used under a "grandfather clause" arrangement. When the programs using these unique systems phase out, so will the management systems.

A schedule for consolidation of the existing 170 management systems is being prepared. DOD expects to cut the number of approved management systems to about 50.

Status of ASPR Committee Cases

The following is a listing (revised as of Oct. 27, 1970) of the cases currently under consideration by the Armed Services Procurement Regulation (ASPR) Committee, of the Office of the Assistant Secretary of Defense (Installations and Logistics).

On items marked by asterisks, the text has been omitted to shorten the listing. The asterisks denote actions taken as shown below:

*—Case closed, no ASPR revisions resulting.

**—Case closed, approved for printing in a subsequent ASPR revision.

***—Case closed, approved for printing subject to further government coordination.

The listing includes subjects of interest to contractors but excludes cases of a minor or editorial nature, those considered "sensitive," and those involving a deviation from the regulation which are processed by the ASPR Committee.

The ASPR Committee meets with representatives of major industry associations periodically to explain the purpose and status of each of the cases under consideration, and to answer questions from industry representatives concerning the cases. All proposed ASPR changes of major policy are forwarded to industry associations in draft form for the review and comments of the association memberships. Industry comments are evaluated by the Defense Department before a final decision on the proposal is made by the ASPR Committee.

** ASPR Case No. 64-656—*Communications Services.*

** ASPR Case No. 67-24—*Advance Understandings of Allowability, ASPR 15-107.*

ASPR Case No. 68-14—*Revisions to ASPR 15-205, Cost Principles on Bid and Proposal and Independent Research and Development.* Previous action on this case has been overtaken by the enactment of Public Law 91-441. Action is now being taken to implement the new statute. It is contemplated that implementation of this law will initially be accomplished by the issuance of a Defense Procurement Circular (DPC) to cover the period through Dec. 31, 1970. Subsequent to the issuance of the DPC, action will be taken to issue revisions of the Independent Research and Development (ASPR 15-205.35) and the Bid and Proposal (ASPR 15-205.3) cost principles to provide permanent implementation of the statute.

ASPR Case No. 68-184—*Clauses for Service Contracts.* To develop a new part for ASPR Section VII to cover service contracts generally, incorporating by reference, to the extent feasible, the fixed-price and cost-reimbursement clauses contained in Parts 1 and 2 of Section VII. The material developed by the subcommittee under this case was forwarded to industry for comment on Sept. 3, 1970.

ASPR Case No. 68-214—*Proposed ASPR 9-203(f) Clause, Rights in Technical Data—For RDT&E and Acquisition Contracts for Major Systems and Subsystems.* To consider modifying the ASPR policy concerning rights in technical data insofar as research, development, test and evaluaton (RDT&E) and acquisition contracts for major systems and subsystems are concerned, by prescribing a special clause for inclusion in prime major systems and prime subsystems RDT&E contracts which would require the contractor to permit subcontractors to sell subcontractor fabricated parts or services directly to the Government without the payment of license fees or other inhibition of. limited rights data furnished by the prime contractor. Industry and government comments have been received and are currently under study.

ASPR Case No. 67-89—*Delinquent Delivery Schedules on Other Than Cost-Reimbursement Type Supply and Service Contracts.* To modify various provisions of Section VIII, Part 6, to clarify the rights and obligations of both parties in the event of delinquent performance. The proposed revisions were forwarded to industry for comment on March 3, 1969. Industry comments have been received. This matter is still under consideration.

**ASPR Case No. 69-6—*"Termination—Determination Whether for Default or Convenience" Clause.* The committee approved certain changes to ASPR 7-105.3 "Stop Work Orders" to authorize conversion of a stop work order to a "Termination for Default" as well as a "Termination for Convenience." Consideration of the proposed clause "Termination—Deferring Determination Whether for Default or Convenience" was suspended indefinitely.

ASPR Case No. 69-12—*Conflict of Interest Clause.* To consider whether further guidance in the regulation and appropriate contractual safeguards should be provided to avoid conflicts of interest which may be occasioned by acquisitions and mergers involving systems engineering contracts. This item was forwarded to industry for comment on July 8, 1969. Comments have been received and are currently under study.

ASPR Case No. 69-24—*ASPR Section IX, Part 2.* To consider whether amendments to Section IX, Part 2, and other pertinent ASPR sections are necessary in view of the re-issued DOD Instruction 5010.12, dated Dec. 5, 1968, entitled "Management of Technical Data." Industry and government comments have been received and are currently under study.

ASPR Case No. 69-76—*Verification of Catalog or Market Price Exceptions Under Public Law 87-653.* To consider the recommendation of the General Accounting Office that ASPR be revised: (i) to require contractors to submit sales data of recent commercial sales for approximately similar quantities of the proposed purchase by the

Government, prior to acceptance by the Government of a catalog or market price; and (ii) to further provide that contracting officers be required to verify the sales data submitted by contractors. The proposed coverage and a new DD Form 633 were forwarded to industry for comment on Sept. 29, 1969. As a result of industry and government agency comments, revised coverage was prepared and resubmitted to industry and government agencies for comment on Sept. 23, 1970.

** ASPR Case No. 69-105—*Health and Safety Clauses.*

ASPR Case No. 69-22—*Revision of ASPR B-311, C-311 and S3-603.* To make necessary revisions to Appendix B-311 and Appendix C-311 and Supplement 3 to provide for uniform reporting by contractors of government property. Revisions to DD Form 1662 are included in the case. Comments have been received and are under consideration.

ASPR Case No. 67-316—*Single-Service Management of Industrial Facilities.* To develop procedures which will provide that only one contract authorizing use of government facilities will be in effect at any one location. It is intended that contracts which authorize the acquisition or furnishing of government facilities will provide for the automatic transfer of those facilities to the "use" contract upon receipt of installation. This matter is still under consideration.

**ASPR Case No. 68-315—*Corporate Administrative Contracting Officer Program.*

* ASPR Case No. 69-114—*Bailment of Government Property to Contractors.*

ASPR Case No. 68-2—*ASPR 15-205.6(f), Deferred Compensation.* To clarify ASPR 15-205.6(f) covering deferred compensation in light of the questions raised concerning: (i) whether deductibility for Federal income tax purposes is a prerequisite to allowability for contract cost purposes; (ii) the extent to which acturial gains and losses (including unrealized market appreciation and depreciation) must be taken into account in determining costs; (iii) whether the cost of improvements in benefits to retired employees are allowable; (iv) whether pay-as-you-go pension payments are allowable; and (v) whether contributions of interest equivalents or unfunded pension liabilities are allowable. This item was forwarded to industry for comment on July 8, 1969. Industry and government agency comments have been received and considered. This matter is now being considered by higher authority as a matter involving major policy.

**ASPR Case No. 68-278—*ASPR Coverage for Training and Educational Costs.*

** ASPR Case No. 69-67—*Forward Pricing Rate Agreements.*

** ASPR Case No. 69-117—*Clarification of Application of CWAS to Limitations Contained in the Cost Principles.*

ASPR Case 69-131—*Warranties—Consequential Damages.* To develop DOD policy and appropriate ASPR coverage for contractual warranties expressed and implied relating to latent and patent defects, as well as consequential damages. This assignment involves not only consideration of the expressed or implied warranties under the "Inspection" clause, but further includes consideration of whether specific contractual provisions should be developed to cover these areas. Material developed under this case was sent to industry and other government agencies for comment on Oct. 19, 1970.

** ASPR Case No. 69-157—*Severance Pay to Employees on Support Service Contracts.*

ASPR Case No. 68-104—*Late Proposals and Modification in Negotiated Procurements.* To consider revising ASPR 3-506 covering late proposals and modification thereof in negotiated procurements in light of the numerous General Accounting Office (GAO) decisions in this area. This matter is now being considered by higher authority as a matter involving major policy.

ASPR Case No. 68-25—*Omnibus General Accounting Office (GAO) and DOD Audit Clauses.* To consider the feasibility of developing an omnibus GAO Examination of Records clause and an omnibus DOD Audit clause to replace the existing Examination of Records clauses and the numerous DOD Audit clauses. The development of a single Examination of Records clause has been undertaken in conjunction with representatives of the GAO. Similarly, a draft of a proposed single DOD Audit clause has been developed. Industry and government agency comments have been received and are under consideration.

ASPR Case No. 69-161—*Evaluation Criteria.* To undertake the development of additional guidance of evaluation criteria to be included in solicitations, thus giving effect to numerous General Accounting Office (GAO) decisions that prospective offerors should be advised of the relative importance to be attached to each evaluation factor. This matter is still under study.

ASPR Case No. 69-173—*Revision of Billing Prices Under Incentive Contracts and Price Redetermination Contracts.* To review the ASPR 7-108 Incentive Price Revision and the 7-109 Price Redetermination clauses and to recommend changes therein to permit upward adjustment of billing prices to conform to the policy in ASPR 3-404(a)(4). The military services have been authorized to deviate from the restrictions of the clauses pending the issuance of revised clauses which are currently being developed. The revised clauses and the clarification of 3-404 were forwarded to industry and government agencies for comment on Oct. 12, 1970.

ASPR Case No. 69-192—*Pricing of Indefinite Delivery Type Contracts.* To consider revising ASPR 3-409 to modify the restriction that indefinite delivery type contracts must provide for: (i) firm fixed prices, (ii) price escalation, or (iii) price redetermination, by allowing pricing on the basis of common manufacturers' price lists or industry pricing guides. This matter is presently under study.

ASPR Case No. 69-197—*Contractor Procurement System Review (CPSR).* To consider expanding existing ASPR coverage on CPSRs and consent to subcontract provisions to provide more detailed guidance. A report on this subject currently is being considered.

ASPR Case No. 69-249—*Time Extensions.* To consider the inclusion of a Time Extensions clause in construction contracts in which liquidated damages are included. A clause clarifying the existing rights of the Government, under the clauses set forth in ASPR 7-602.5 "Termination for Default—Damages for Delay—Time Extensions" and ASPR 7-602.3 "Changes" (February 1968 version), to extend the time for completion of work when a contractor is delayed by any of certain enumerated excusable delays. Industry comments have been received and are under consideration.

** ASPR Case No. 70-14—*Proposed Revision of ASPR Appendix I.*

ASPR Case No. 70-19—*Wage and Material Price Escalation.* To review existing ASPR escalation provisions to determine the advisability of developing additional wage and material price escalation clauses for use in contracts for complex weapon systems to be produced over an extended period of time. Clauses developed by a Special Study Group established to review this subject, were forwarded to industry for comment on May 18, 1970.

ASPR Case No. 70-38—*Proposed Change to ASPR 15-205.16, Insurance and Indemnification.* To consider a suggestion that ASPR 15-205.16 be revised to specifically limit allowable costs of self-insurance for future liabilities to an amount determined on a present value basis. Material developed under this case was sent to industry and other government agencies for comment Aug. 3, 1970.

ASPR Case No. 70-39—*Allocation of Contractors' Cost for Special Facilities.* To consider additions or revisions to Section XV to clarify cost allocation procedures under ASPR 15-201.4 in general, and allocation of the costs of special facilities such as wind tunnels, in particular. Material developed under this case was sent to industry and other government agencies for comment on Sept. 3, 1970.

ASPR Case No. 70-41—*Capital Data Employed.* To consider the advisability of initiating a policy change to use capital-employed as a factor in developing pre-negotiation profit objectives. This matter has been assigned to a specially selected subcommittee and currently is under study. Worksheets developed by the subcommittee to obtain the necessary data to test the concept were submitted to industry and other government agencies for comment on Oct. 9, 1970.

ASPR Case No. 68-69—*Proposed Addition—Special Tooling Retention/Storage Agreements.* To consider the development of guidance and a standard contract format for use when special tooling or special test equipment is to be stored at the contractor's facility for use on subsequent production contracts. Proposed coverage was forwarded to industry for comment on April 10, 1970. Comments have been received and are currently under study.

ASPR Case No. 70-55—*Clarification on Computed Bond Requirements.* To provide guidance on the amount of bond requirements for requirement-type construction contracts. This matter currently is under study.

ASPR Case No. 70-59—*ASPR 15-205.34—Rental Costs.* To correct a misconception of the intent of ASPR 15-205.34 by substituting the word "property" for "facilities and equipment." Industry and other government agencies comments on the proposed revision have been received and are under consideration.

ASPR Case No. 70-62—*Proposed Changes to Milk Price Adjustment Clause in ASPR 7-1301.8 and 7-1301.9.* To resolve the difficulties being encountered in establishing reasonable prices for milk products under the present ASPR clauses by substituting a cancellation provision. The proposed coverage was submitted to appropriate industry associations and the General Accounting Office for comment on Aug. 10, 1970.

ASPR Case No. 70-64—*Personnel Management Review Including Executive Compensation.* To consider the advisability of adopting on a DOD-wide basis a procedure developed by Defense Supply Agency to review a contractor's compensation structure in order to determine if it will produce reasonable costs under government contracts. This matter has been assigned to a subcommittee and is currently being studied.

ASPR Case No. 70-67—*Revision of ASPR—Termination of Use Notices.* To consider amending the clauses set forth in ASPR 7-702.23 and 7-702.24 concerning contractor written notice of termination of use of additional facilities, by incorporating a 10-day idle reporting time. This matter has been assigned to a subcommittee and currently is under study.

ASPR Case No. 70-78—*Duty-Free Entry Clause Notices.* To revise the procedures resulting from clauses set forth in ASPR 6-603 and 6-605 by requiring the contractor to notify the contract administration office of imported supplies only when an actual award is made to a foreign supplier; and by eliminating the requirement that a foreign supplier forward a copy of the bill of lading to a designated government representative. Copies of the revised ASPR coverage on this matter were forwarded to industry and other government agencies for comment on Sept. 4, 1970.

ASPR Case No. 70-83—*Rights in Data—Computer Programs.* To consider the desirability of developing a standard ASPR Special Rights in Data clause for computer systems analyses and programming services. This matter was assigned to a subcommittee and currently is under study.

ASPR Case No. 70-90—*Interpretation of ASPR 11-401.1, Tax Clause.* To determine whether social security taxes should be subject to the adjustment procedures of the 11-401.1 Tax clause. This matter was assigned to a subcommittee and currently is under study.

ASPR Case No. 70-103—*Control of Constructive Changes and Other Claims on Nonconstruction Contract.* To consider the need for clauses in ASPR similar to those in Navy Procurement Circular (NPC) No. 15 to control the constructive changes problem. The committee authorized the Navy to continue its test of the clauses in NPC No. 15 until June 30, 1971. Other military services may use the NPC No. 15 clauses on a case-by-case basis after committee concurrence. With regard to a related Army clause, Preproduction Evaluation, the committee determined

that the Army has the right to use the clause when appropriate. The overall problem of controlling constructive changes was assigned to a subcommittee and currently is being studied.

ASPR Case No. 70-108—*Proposed Revision to ASPR Relating to Policy Guidance on Major Weapon System Acquisition.* To consider the impact on ASPR of Deputy Secretary of Defense Packard's policy memorandum of May 28, 1970. This matter was assigned to a subcommittee and currently is under study. The subcommittee's assignment primarily involves Section III, Part 4, "Types of Contracts," and Section IV, Part 1, "Procurement of Research and Development." In a related case, the ASPR Committee has approved deletion of ASPR 1-330, "Total Package Procurement" as a result of Mr. Packard's memorandum.

ASPR Case No. 70-113—*ASPR 15-204, Application of Principles and Procedures.* To clarify the intent that Section XV be used in the pricing of fixed-price subcontracts whenever the prime contract is subject to Section XV and that fixed-price subcontracts thereunder are subject to cost analysis, price revision, or price redetermination. The proposed coverage on this matter was submitted to industry and other government agencies for comment on Sept. 9, 1970.

ASPR No. 68-174—*Jewel Bearings, ASPR 1-315.* Defense interests require the continued maintenance of an active and versatile mobilization base for the domestic production of jewel bearings and related items. Procurement of jewel bearings by the Government and government contractors under the guidance in the present ASPR 1-315 has not been sufficient to carry out policy ob-objectives in this area. The policy remains unchanged but the coverage is more detailed and explicit. The proposed coverage also contains a new provision relating to standardization requiring that redesign of military items provide for the use of military standard jewel bearings. Industry and other government agency comments have been received and currently are under study.

Naval Ordnance Lab

(*Continued from page 12.*)

touch with industry as it affects the project.

The development of Subroc, the Navy's underwater-to-air-to-underwater missile, is an excellent example of NOL's partnership with industry. Subroc, a missile launched underwater to travel through the air to return to water to seek its target, was a bold, new weapon conceived at NOL. The idea was further developed by contract, with Goodyear Aerospace Corp. the prime contractor, and with NOL providing technical direction. Together they solved many knotty problems of design and construction, and brought the revolutionary idea from the drawing board to production.

It is always of interest to speculate on the future, although this is even more uncertain than usual this year.

The general reduction in defense expenditures and the rising cost of an engineering manyear will surely mean that new starts of major systems will be even more seriously scrutinized. We will have to be more adroit in applying the principles of good old American ingenuity toward making equipment that does the job at lower cost. There must be simpler ways to do things that are not quite so automatic, or comprehensive, or flexible. More attention must be given to simplicity in maintenance and lucidity in design. Paradoxically, the key to achieving this goal is true technical competence and a first hand knowledge of the operating environment. These things are acquired, among other ways, by the expenditure of research and development effort. We will have to exercise more restraint in going into production while still spending money on design and test.

The recently reaffirmed policy of "try before buy" will call for increased cooperation between potential industry producers and government laboratories, charged with the task of determining that a development really does perform as it is supposed to before the Government commits decreasing resources to large-scale production.

SUPERSONIC INLET design model is mounted in a 4-foot transonic tunnel at the Arnold Engineering Development Center, Arnold AFS, Tenn., by Stan Ton, left, of the Northrop Corp., and Bobby Moreland, ARO, Inc., contract operator of the center. Performance of air inlets for supersonic jet aircraft may be determined in high-speed tunnels without having to actually fly the aircraft. By altering tunnel pressure and Mach number, most of the conditions of altitude, speed and attitude the aircraft will encounter in actual flight can be simulated to determine the inlet's performance. The Air Force Systems Command's Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, is sponsoring tests directed toward development of propulsion systems for future applications.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Vernon McKenzie has been named as Special Asst. to the Asst. Secretary of Defense (Health and Environment).

C. Stuart Broad has been designated Dir. for Equal Opportunity (Civilian) in the Office of the Dep. Asst. Secretary of Defense (Equal Opportunity), Office of the Asst. Secretary of Defense (Manpower and Reserve Affairs).

Dr. Robert Langelier has been named Staff Specialist for Sattelite Communications Systems, Office of the Asst. to the Secretary of Defense (Telecommunications).

New assignments in the Advanced Research Projects Agency are: Dr. Eric H. Willis, Dir., Nuclear Monitoring Research; and Dr. Maurice J. Sinnott, Dir., Materials Sciences.

Capt. Jacob W. Updegrove, CEC, USN, has replaced Col. Jean E. Crabtree, USAF, as Staff Dir. for Installations and Services, Hq. Defense Supply Agency. Col. Crabtree retired.

Capt. William A. Johannesen, SC, USN, has been assigned as Executive Director, Contract Administration Services (CAS), Hq. Defense Supply Agency.

Col. Forrest R. Dupont, USAF, is the new Commander, Defense Contract Administration Services, St. Louis Region, St. Louis, Mo.

DEPARTMENT OF THE ARMY

Gen. (selectee) Henry A. Miley, Jr. is the new Commanding General, Army Materiel Command. He replaces Gen. Ferdinand J. Chesarek, who has retired.

Lt. Gen. (selectee) Woodrow W. Vaughan, replaces Gen. Miley as Dep. Commanding General, Army Materiel Command.

Lt. Gen. George I. Forsythe has been assigned as Project Manager, All-volunteer Army, an effort designed to end the draft by mid-1973. In his new position, Gen. Forsythe will report directly to Secretary of the Army Stanley R. Resor and Gen. W. C. Westmoreland, Army Chief of Staff. Gen. Forsythe was formerly Commanding General of the Army Combat Developments Command.

The new Commanding General, U. S. Army Combat Developments Comand, Fort Belvoir, Va., is Lt. Gen. (selectee) John Norton. Gen. Norton served previously as Dep. Project Manager, Project Mobile Army Sensor Systems Test Evaluation and Review (MASSTER), Fort Hood, Tex. Major General George P. Seneff Jr. is the new Project Manager of MASSTER.

Lt. Gen. (selectee) Robert R. Williams, formerly Dep. Asst. Chief of Staff for Force Development has been named Asst. Chief of Staff for Force Development, Hq., U.S. Army. He will replace Lt. Gen. Frederick C. Weyand.

Col. Sam H. Sharp has been named Dep. Chief of Staff for the Army Strategic Communications Command, Fort Huachuca, Ariz. Col. Sharp succeeds Col. Emil V. B. Edmond who was retired.

Lt. Col. Calvin A. Storment has been named Commanding Officer of the East Coast Telecommunications Center, Fort Detrick, Md.

Lt. Col. Albert M. Desselle, USMC, became the first Marine Corps liaison officer to join the Army Computer Systems Command headquarters staff, Fort Belvoir, Va.

DEPARTMENT OF THE NAVY

Adm. Jackson D. Arnold, who has been performing the duties of Chief of Naval Material and Commander, Naval Material Command since the retirement of Adm. I. J. Galantin, has been elevated to the rank of admiral and position of Chief of Naval Material. He is the first aeronautical engineering duty officer to attain the rank of admiral.

Vice Adm. (selectee) George E. Moore II, SC, relieves Adm. Arnold as the Vice Chief of Naval Material. Admiral Moore is the only Navy Supply Corps officer serving in the rank of vice admiral.

Gen. (selectee) Keith B. McCutcheon, USMC, will be the new Asst. Commandant of the Marine Corps. He replaces Gen. Lewis Walt, who will retire Feb. 1, 1971.

Lt. Gen. (selectee) Donn J. Robertson, USMC will relieve Gen. McCutcheon as Commanding General of the III Marine Amphibious Force.

In Hq., U.S. Marine Corps, Lt. Gen. John R. Chaisson, USMC, will become Chief of Staff. He succeeds Lt. Gen. William J. Van Ryzin, USMC, who will retire on May 1, 1971. Lt. Gen. (selectee) Hugh M. Elwood, USMC, will replace Gen. Chaisson as Dep. Chief of Staff (Plans, and Programs).

Rear Adm. William R. McClendon has been assigned as Dir., Aviation Plans Div., Office of the Chief of Naval Operations.

Rear Adm. W. J. Moran is the new Commander, Naval Weapons Center, China Lake, Calif. Capt. Melvin R. Etheridge, former Commander, has retired.

Capt. Norman D. Chetlin will be the new commanding officer of the Fleet Material Support Office, Mechanicsburg, Pa. He will replace Capt. Donald A. Hempson, who will retire Jan. 1. Capt. Richard D. Johnson will succeed Capt. Chetlin as the Fleet Material Support Office Executive Officer.

DEPARTMENT OF THE AIR FORCE

Brig. Gen. William H. Best Jr. is now Commander, Air Weather Service, Scott AFB, Ill., which is also the global environment-support agency for the Army. Col. Thomas A. Aldrich is the new Vice Commander of the Air Weather Service.

Col. John G. Dailey, Commander of the Air Force Human Resources Laboratory, Brooks AFB, Tex., has retired.

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PROCUREMENT

PUBLICATIONS

RESEARCH AND DEVELOPMENT

SHIPS

Status of Funds Quarterly Report

Outlays

Fourth Quarter, Fiscal Year 1970

(Thousands of Dollars)

Department of Defense	Outlays				Unpaid obligations	
	Apr 1970	May 1970	Jun 1970	Cum thru 30 Jun 1970	At start of year	As of 30 Jun 1970
Military Personnel						
Active forces	1,941,678	1,986,656	2,100,633	21,976,604	592,306	392,282
Reserve forces	77,039	79,697	136,214	1,054,136	152,294	216,266
Undistributed	103,174	−54,833	64,174	—	—	—
Total—Military Personnel	2,121,891	1,961,518	2,301,022	23,030,740	744,601	608,538
Retired Military Personnel						
Retired Pay, Defense	248,058	249,418	250,981	2,849,262	6,854	9,799
Operation and Maintenance	1,816,185	1,800,534	1,929,664	21,608,922	3,924,991	3,871,232
Procurement						
Aircraft	682,495	634,684	661,122	7,926,435	7,701,062	5,776,572
Missiles	249,589	261,514	306,213	2,912,309	2,516,098	2,686,931
Ships	176,630	184,138	109,958	2,065,660	3,085,258	2,956,147
Tracked combat vehicles	31,958	30,712	38,660	320,977	454,414	339,517
Ordnance, vehicles and related equipment	449,129	426,096	590,466	5,266,690	5,690,581	4,030,014
Electronics and communications	95,992	62,758	163,729	1,174,306	1,621,409	1,469,164
Other procurement	147,667	107,265	163,155	1,839,864	2,016,381	2,083,572
Undistributed	−29,136	−19,891	−400,550	77,488	128,926	48,695
Total—Procurement	1,804,913	1,687,221	1,632,753	21,583,728	23,215,028	19,890,614
Research, Development, Test, & Evaluation						
Military sciences	73,320	76,244	112,548	948,078	712,919	668,097
Aircraft	94,312	128,211	111,929	1,238,830	681,935	805,367
Missiles	181,879	153,649	202,086	2,196,279	1,077,605	1,005,599
Astronautics	59,217	38,951	58,387	762,560	462,428	405,903
Ships	35,794	26,945	32,488	362,393	284,836	228,517
Ordnance, vehicles and related equipment	25,236	22,670	30,011	320,938	229,411	167,915
Other equipment	75,317	69,535	59,069	882,779	501,780	478,261
Program-wide management & support	37,584	40,695	36,889	462,254	282,019	203,550
Undistributed	2,788	−15,903	−25,459	2,176	38,151	21,673
Total—Research, Development, Test, and Evaluation	585,444	540,998	617,448	7,166,277	4,261,084	3,984,882
Military Construction	80,087	75,824	98,221	1,168,142	1,806,093	1,666,056
Family Housing	49,617	47,765	51,683	613,600	256,946	201,617
Civil Defense	5,940	6,652	7,464	80,084	55,255	43,569
Other—Special Foreign Currency Program	84	67	135	884	363	1,239
Revolving and Management Funds	−169,287	−176,009	−242,388	−807,073	6,615,240	5,406,532
Applicable receipts	−11,900	−6,542	−8,847	−135,194	—	—
Subtotal—Federal Funds	6,530,432	6,187,449	6,638,133	77,159,372	40,885,960	36,174,076
Trust Funds	926	−426	−1,338	2,287	4,821	4,449
Interfund Transactions	−1	−2,148	5	−6,806	—	—
Total—Military Functions	6,531,356	6,184,875	6,636,801	77,154,853	40,890,771	36,178,526
Military Assistance						
Federal Funds	47,532	71,183	50,807	593,215	1,562,839	1,180,972
Trust Funds	24,748	67,072	4,656	137,581	227,015	197,209
Total—Military Assistance	72,279	138,256	55,463	730,796	1,789,854	1,378,182
TOTAL—DEPARTMENT OF DEFENSE	6,603,634	6,323,131	6,692,264	77,885,649	42,680,624	36,556,707

Department of the Army

	Apr 1970	May 1970	Jun 1970	Cum thru 30 Jun 1970	At start of year	As of 30 Jun 1970
Military Personnel						
Active forces	773,851	803,130	933,267	9,017,713	213,798	48,731
Reserve forces	47,073	47,456	93,199	683,249	115,658	169,552
Undistributed	101,684	−53,796	76,295	—	—	—
Total—Military Personnel	922,607	796,791	1,102,759	9,700,961	329,457	218,283
Operation and Maintenance	694,205	649,667	781,814	7,879,151	1,337,348	1,299,217
Procurement						
Aircraft	56,322	76,174	72,147	836,916	1,063,782	688,916
Missiles	55,582	74,555	123,144	743,449	848,404	788,041
Tracked combat vehicles	28,795	30,284	36,103	302,174	431,068	313,832
Ordnance, vehicles and related equipment	240,478	197,484	275,700	2,454,960	2,965,280	2,007,170
Electronics and communications	−4,423	−3,755	90,335	342,594	581,475	440,476
Other procurement	59,906	31,899	89,738	494,287	682,896	835,266
Undistributed	−37,245	−18,645	−396,284	31,741	89,722	15,419
Total—Procurement	399,415	387,996	290,883	5,206,121	6,612,627	5,149,121
Research, Development, Test, and Evaluation						
Military sciences	12,028	8,687	36,665	161,335	96,888	88,015
Aircraft	10,442	7,746	8,280	86,761	89,782	81,045
Missiles	77,468	57,800	107,661	849,879	419,831	335,107
Astronautics	859	553	350	7,444	3,813	3,674
Ordnance, vehicles and related equipment	13,963	12,511	14,900	169,131	115,667	100,453
Other equipment	28,185	30,330	14,075	333,107	196,095	173,811
Program-wide management and support	3,496	3,863	4,486	53,970	32,104	29,835
Undistributed	−1,995	−5,023	−21,753	3,760	13,651	3,495
Total—Research, Development, Test, and Evaluation	144,446	116,467	168,654	1,665,477	967,391	875,435
Military Construction	47,937	23,768	41,143	457,834	776,104	339,562
Revolving and Management Funds	−35,585	−69,788	−55,078	−113,314	1,856,891	1,368,276
Applicable Receipts	−5,004	−3,001	−3,578	−70,833	—	—
Subtotal—Federal Funds	2,168,022	1,901,903	2,321,098	24,725,397	11,880,257	9,799,893
Trust Funds	960	−1,274	−1,649	−624	89	3
TOTAL—DEPARTMENT OF THE ARMY	2,168,982	1,900,630	2,319,447	24,724,772	11,880,346	9,799,895

Department of the Navy

	Outlays				Unpaid obligations	
	Apr 1970	May 1970	Jun 1970	Cum thru 30 Jun 1970	At start of year	As of 30 Jun 1970
Military Personnel						
Active forces	654,872	532,870	614,044	6,489,547	168,734	174,773
Reserve forces	14,771	15,388	21,725	181,480	23,320	30,806
Undistributed	10,634	−4,122	−13,586	—	—	—
Total—Military Personnel	680,279	543,696	622,181	6,671,026	192,054	205,579
Operation and Maintenance	456,649	443,925	432,626	5,552,548	1,537,613	1,650,454
Procurement						
Aircraft	218,886	210,775	228,129	2,466,909	2,861,615	2,190,060
Missiles	64,702	65,218	74,061	701,655	703,716	789,424
Ships	176,630	184,138	109,958	2,065,660	3,085,253	2,956,147
Tracked combat vehicles	3,163	428	2,557	18,803	23,846	25,685
Ordnance, vehicles and related equipment	88,717	117,097	137,896	1,398,755	1,536,287	1,122,482
Electronics and communications	28,939	29,822	38,155	416,816	576,715	532,523
Other procurement	49,378	27,904	58,870	848,293	1,194,841	1,083,515
Undistributed	1,178	−1,055	−435	32,658	71,369	28,264
Total—Procurement	631,593	634,327	649,191	7,944,549	10,053,142	8,728,100
Research, Development, Test, and Evaluation						
Military sciences	11,357	12,935	17,302	164,912	129,992	101,989
Aircraft	55,761	71,931	72,561	594,422	253,929	421,194
Missiles	37,598	36,280	35,607	490,974	291,240	253,019
Astronautic	2,378	2,561	3,220	21,788	15,598	12,394
Ships	35,794	26,945	32,488	362,393	284,836	228,517
Ordnance, vehicles and related equipment	11,278	10,159	15,111	151,807	113,744	67,462
Other equipment	20,217	17,622	22,575	196,434	77,139	119,732
Program-wide management and support	12,036	8,652	7,928	105,826	219,464	127,399
Undistributed	−263	−4,948	−1,996	−4,308	14,446	7,538
Total—Research, Development, Test, and Evaluation	186,151	182,142	204,796	2,084,248	1,400,388	1,339,735
Military Construction	12,547	24,653	33,109	333,272	616,207	567,294
Revolving and Management Funds	−78,973	−7,503	28,374	−45,134	2,190,935	2,007,542
Applicable receipts	−3,503	−2,216	−3,024	−38,606	—	—
Subtotal—Federal Funds	1,884,742	1,818,965	1,967,254	22,501,904	15,999,338	14,498,705
Trust Funds	880	362	601	6,531	277	479
Interfund Transactions	−1	−2,148	5	−6,806	—	—
TOTAL—DEPARTMENT OF THE NAVY	1,885,620	1,817,178	1,967,860	22,501,628	15,999,615	14,499,184

Department of the Air Force

Military Personnel,						
Active forces	512,956	601,154	553,323	6,469,344	209,774	168,779
Reserve forces	15,195	16,854	21,291	189,408	13,316	15,898
Undistributed	−9,146	3,086	1,466	—	—	—
Total—Military Personnel	519,006	621,092	576,080	6,658,752	223,090	184,676
Operation and Maintenance	567,251	596,896	595,713	6,995,222	953,240	805,617
Procurement						
Aircraft	407,287	347,685	360,846	4,622,610	3,775,665	2,897,596
Missiles	129,306	121,741	109,008	1,467,205	964,878	1,109,466
Ordnance, vehicles and related equipment	119,909	111,485	176,848	1,412,290	1,188,875	840,334
Electronics and communications	70,492	36,547	34,631	408,489	455,849	490,567
Other procurement	34,242	46,349	12,353	438,618	95,195	101,127
Undistributed	6,936	−146	−3,872	13,089	17,834	5,012
Total—Procurement	768,170	663,661	680,815	8,362,151	6,498,290	5,444,102
Research, Development, Test, and Evaluation						
Military sciences	11,064	14,423	10,584	142,416	90,842	86,221
Aircraft	28,109	48,534	31,088	557,647	338,224	303,128
Missiles	66,813	59,569	58,818	855,426	366,534	367,473
Astronautics	55,980	35,837	54,817	723,918	483,017	384,395
Other equipment	26,915	21,583	22,419	353,148	228,546	184,718
Programwide management and support	22,052	28,180	23,975	302,458	30,451	46,316
Undistributed	5,046	−5,937	−1,710	2,724	10,054	5,590
Total—Research, Development, Test, and Evaluation	215,976	202,191	199,990	2,937,137	1,497,668	1,377,840
Military Construction	18,785	26,738	22,906	365,760	393,810	183,507
Revolving and Management Funds	−25,841	−55,515	−75,058	−422,569	1,276,941	—
Applicable Receipts	−3,388	−1,321	−2,221	−25,704	—	1,139,994
Subtotal—Federal Funds	2,059,957	2,053,744	2,007,224	24,870,749	10,843,089	9,135,736
Trust Funds	−916	486	−287	−3,619	4,328	3,967
TOTAL—DEPARTMENT OF THE AIR FORCE	2,059,040	2,054,230	2,006,936	24,867,129	10,847,362	9,139,703

Defense Agencies/Office of the Secretary of Defense

	Outlays				Unpaid obligations	
	Apr 1970	May 1970	Jun 1970	Cum thru 30 Jun 1970	At start of year	As of 30 Jun 1970
Operation and Maintenance	94,516	107,105	115,867	1,139,851	98,268	111,547
Procurement						
Ordnance, vehicles and related equipment	25	80	22	685	139	28
Electronics and communications	984	139	608	6,457	7,876	5,598
Other procurement	4,131	1,113	2,194	63,766	43,449	63,664
Undistributed	−5	−45	41	—	—	—
Total—Procurement	5,135	1,237	2,864	70,907	50,964	69,291
Research, Development, Test and Evaluation						
Military sciences	38,871	40,199	49,007	479,415	395,197	301,872
Military Construction	820	665	1,063	11,277	19,972	15,693
Revolving and Management Funds	−28,887	−43,209	−140,626	−226,056	1,281,474	890,720
Applicable receipts	−6	−4	−24	−51	—	—
Subtotal—Federal funds	110,449	105,993	27,652	1,475,343	1,840,875	1,479,123
Trust funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES/OSD	110,449	105,993	27,652	1,475,343	1,840,875	1,479,123

Defense-Wide

Military Retired Personnel	248,058	249,418	260,981	2,849,262	6,354	9,799
Operation and Maintenance	3,564	2,941	4,648	42,140	3,528	4,896
Family Housing	49,617	47,766	51,683	613,600	256,946	201,617
Other Special Foreign Currency Program	84	67	135	884	368	1,239
TOTAL—DEFENSE-WIDE	301,324	300,191	307,442	3,505,896	267,186	217,051

Office of Civil Defense

Civil Defense	5,940	6,652	7,464	80,084	55,255	43,569

Obligations

Department of Defense	Available for obligation	Obligations			Cum thru 30 Jun 1970	Unobligated balance 30 Jun 1970
		Apr 1970	May 1970	Jun 1970		
Military Personnel						
Active forces	22,074,800	1,959,940	1,972,790	1,794,694	22,070,935	3,865
Reserve forces	1,147,511	101,784	106,644	157,001	1,134,416	13,094
Total—Military Personnel	23,221,811	2,061,724	2,079,433	1,951,696	23,205,351	16,460
Retired Military Personnel						
Retired Pay, Defense	2,858,000	248,568	249,938	251,297	2,853,234	4,766
Operation and Maintenance	28,977,090	2,061,658	1,680,782	2,645,465	28,902,115	74,975
Procurement						
Aircraft	9,912,845	457,195	618,472	1,348,631	6,437,658	3,475,187
Missiles	4,097,303	211,598	135,804	527,680	3,156,319	940,984
Ships	4,485,249	68,898	71,591	851,984	2,034,402	2,450,847
Tracked combat vehicles and other weapons	370,444	14,410	11,122	62,055	288,839	81,605
Ordnance, vehicles and related equipment	6,712,426	335,915	191,107	514,644	5,146,445	1,565,981
Electronics and communications	2,194,895	94,385	58,146	261,229	1,184,776	1,010,119
Other procurement	2,986,293	149,187	151,709	395,518	2,263,673	722,620
Undistributed	418,923	−778	−767	3,051	−231	419,154
Total—Procurement	31,178,878	1,330,814	1,232,188	3,464,797	20,511,882	10,666,496
Research, Development, Test, and Evaluation						
Military sciences	1,090,285	73,436	70,915	174,428	956,890	133,395
Aircraft	1,671,266	78,841	85,489	151,688	1,372,214	299,052
Missiles	2,496,822	97,842	75,128	224,404	2,287,446	209,376
Astronautics	879,156	49,691	34,902	98,650	781,505	97,651
Ships	960,568	11,015	13,490	18,190	914,202	46,366
Ordnance, vehicles, and related equipment	339,511	17,672	13,291	40,238	268,433	71,078
Other equipment	1,196,697	60,693	49,767	119,061	905,090	291,607
Program-wide management and support	666,317	42,496	46,952	68,279	593,317	73,000
Emergency fund	—	—	—	—	—	—
Undistributed	−494	−313	−465	558	−3,529	3,035
Total—Research, Development, Test and Evaluation	8,700,128	430,873	339,420	895,485	7,475,572	1,224,556
Military Construction	3,018,081	94,453	121,540	288,300	1,536,954	1,481,127
Family Housing	690,163	64,856	44,803	82,582	576,877	113,286
Civil Defense	75,205	4,328	2,946	7,814	69,708	5,496
Other—Special Foreign Currency	15,162	329	330	359	1,760	13,401
Revolving and Management Funds	21,565,971	1,608,131	1,486,771	1,640,244	20,386,697	1,179,273
Offsetting receipts	−135,194	−11,797	−6,468	−9,054	−135,194	—
Subtotal—Federal funds	115,164,793	7,893,933	7,231,682	11,218,986	100,384,957	14,779,836
Trust funds	93,473	6,736	3,608	4,960	60,047	33,426
Interfund transactions	−6,806	−1	−2,148	5	−6,806	—
Total—Military Functions	115,251,460	7,900,667	7,233,143	11,223,950	100,438,198	14,813,262
Military Assistance						
Federal funds	415,162	69,246	12,878	44,626	411,497	3,665
Trust funds	2,340,201	41,312	30,396	27,573	107,775	2,232,426
Total—Military Assistance	2,755,364	110,558	43,274	72,199	519,272	2,236,091
TOTAL—DEPARTMENT OF DEFENSE	118,006,823	8,011,224	7,276,417	11,296,150	100,957,470	17,049,354

Department of the Army

	Available for obligation	Obligations			Cum thru 30 Jun 1970	Unobligated balance 30 Jun 1970
		Apr 1970	May 1970	Jun 1970		
Military Personnel						
Active forces	8,990,188	831,181	781,979	695,987	8,990,188	—
Reserve forces	763,571	66,629	77,046	106,122	750,629	12,941
Total—Military Personnel	9,758,759	897,810	859,024	802,110	9,740,817	12,941
Operation and Maintenance	8,828,857	759,088	633,979	1,069,606	8,773,142	55,715
Procurement						
Aircraft	813,199	64,159	—25,658	151,718	482,779	330,420
Missiles	990,196	23,081	22,765	48,974	719,520	270,676
Tracked combat vehicles	331,852	18,622	11,108	58,488	267,697	64,155
Ordnance, vehicles and related equipment	4,165,647	253,873	120,052	311,691	3,091,455	1,074,192
Electronics and communications	802,100	22,189	15,124	89,615	298,408	503,692
Other procurement	955,485	23,604	41,148	201,111	653,454	302,031
Undistributed	215,336	180	807	2,673	3,473	211,863
Total—Procurement	8,273,815	400,408	185,841	864,065	5,516,786	2,757,028
Research, Development, Test, and Evaluation						
Military sciences	193,503	10,582	8,267	24,452	173,840	19,663
Aircraft	141,273	8,398	8,777	17,791	82,909	58,364
Missiles	940,094	21,772	27,884	71,053	842,206	97,888
Astronautics	15,442	808	194	6,505	12,384	3,058
Ordnance, vehicles, and related equipment	220,631	14,046	13,065	28,795	163,030	57,601
Other equipment	488,346	21,181	22,208	59,565	344,668	143,678
Program-wide management and support	66,298	3,906	2,948	5,928	55,719	10,579
Undistributed	8,792	—85	—220	792	—215	4,007
Total—Research, Development, Test and Evaluation	2,069,879	75,658	83,128	214,881	1,674,541	394,838
Military Construction	1,488,307	89,234	53,840	181,983	819,808	668,499
Revolving and Management Funds	5,396,766	887,823	884,072	465,097	4,952,108	444,658
Applicable receipts	—70,833	—4,904	—2,910	—3,882	—70,833	—
Subtotal—Federal Funds	35,740,048	2,555,112	2,197,060	3,593,810	31,406,369	4,333,679
Trust Funds	32,840	2,527	2	74	15,286	17,554
Total—Department of the Army	35,772,888	2,557,640	2,197,061	3,593,884	31,421,655	4,351,233

Department of the Navy

Military Personnel						
Active forces	6,531,706	617,224	536,539	550,583	6,528,868	2,898
Reserve forces	191,024	17,859	12,876	26,602	190,871	153
Total—Military Personnel	6,722,730	635,084	549,414	577,185	6,719,739	2,991
Operation and Maintenance	6,598,884	646,733	896,982	859,140	6,593,858	4,633
Procurement						
Aircraft	2,768,182	117,409	134,840	491,512	1,846,546	921,586
Missiles	1,030,561	31,696	18,844	272,082	816,236	214,326
Ships	4,485,249	68,898	71,591	351,984	2,034,402	2,450,847
Tracked combat vehicles	38,592	488	19	3,572	21,142	17,450
Ordnance, vehicles and related equipment	1,339,829	49,318	26,110	78,077	990,664	349,165
Electronics and communications	597,380	29,547	24,818	49,034	380,777	216,603
Other procurement	1,414,706	75,482	58,384	166,711	1,073,396	341,309
Undistributed	72,800	—142	—1,387	645	—3,970	76,770
Total—Procurement	11,747,248	372,690	827,222	1,413,013	7,159,191	4,588,056
Research, Development, Test, and Evaluation						
Military sciences	176,826	7,315	11,813	16,584	142,483	34,343
Aircraft	860,057	39,354	7,589	68,866	761,758	98,299
Missiles	521,282	18,069	8,941	54,587	468,928	52,354
Astronautics	20,501	1,055	182	2,346	19,158	1,343
Ships	360,568	11,015	13,490	18,190	314,202	46,366
Ordnance, vehicles and related equipment	118,880	3,620	226	11,443	105,408	13,472
Other equipment	269,052	10,869	10,078	14,408	240,568	28,484
Program-wide management and support	258,428	14,718	17,651	18,929	206,739	51,689
Undistributed	—15,888	—160	8	—61	—2,370	—13,518
Total—Research, Development, Test, and Evaluation	2,569,706	105,856	70,528	204,791	2,256,874	312,832
Military Construction	1,007,094	44,589	88,731	75,958	554,723	452,371
Revolving and Management Funds	7,966,510	650,589	528,228	527,281	7,285,068	681,442
Applicable Receipts	—38,606	—3,502	—2,216	—8,002	—38,606	—
Subtotal—Federal Funds	36,573,066	2,358,038	1,903,888	3,654,961	30,530,841	6,042,225
Trust Funds	16,654	1,308	940	1,655	13,627	3,026
Interfund Transactions	—6,806	—1	—2,148	5	—6,806	—
TOTAL—DEPARTMENT OF THE NAVY	36,582,913	2,359,339	1,902,683	3,656,620	30,537,662	6,045,251

Department of the Air Force

Department of the Air Force	Available for obligation	Obligations Apr 1970	May 1970	Jun 1970	Cum thru 30 Jun 1970	Unobligated balance 30 Jun 1970
Military Personnel						
Active forces	6,552,406	511,535	654,272	548,124	6,551,879	527
Reserve forces	192,916	17,296	16,722	24,277	192,916	—
Total—Military Personnel	6,745,322	528,830	670,994	572,401	6,744,795	527
Operation and Maintenance	7,298,995	644,343	550,590	595,190	7,286,418	12,577
Procurement						
Aircraft	6,331,514	275,693	504,290	705,401	4,108,333	2,223,181
Missiles	2,076,546	156,871	94,195	206,630	1,620,563	455,983
Ordnance, vehicles and related equipment	1,206,289	33,215	45,942	124,875	1,063,749	142,540
Electronics and communications	786,300	42,574	17,749	121,095	500,912	285,388
Other procurement	491,814	40,917	58,693	10,384	444,409	46,905
Undistributed	128,771	−811	−187	−167	266	128,505
Total—Procurement	11,020,734	548,898	715,684	1,168,219	7,738,234	3,282,500
Research, Development, Test, and Evaluation						
Military sciences	172,592	11,036	10,433	21,787	158,070	14,522
Aircraft	669,936	36,094	19,073	65,532	527,547	142,389
Missiles	1,035,446	57,501	88,903	98,764	976,312	59,134
Astronautics	843,213	47,827	84,576	89,799	749,963	93,250
Other equipment	439,299	28,643	16,881	45,088	319,854	119,445
Program-wide management and support	341,591	23,877	26,953	43,422	330,859	10,732
Undistributed	11,602	−118	−253	−178	−944	12,546
Total—Research, Development, Test, and Evaluation	3,513,679	204,861	145,366	364,214	3,061,660	452,019
Military Construction	462,852	10,250	27,097	28,389	155,426	307,426
Revolving and Management Funds	5,418,088	359,159	385,629	392,710	5,400,240	17,848
Offsetting Receipts	−25,704	−3,384	−1,330	−2,218	−25,704	—
Subtotal—Federal Funds	34,433,966	2,292,457	2,494,039	3,118,904	30,361,068	4,072,897
Trust Funds	43,979	2,900	2,667	3,231	31,134	12,845
TOTAL—DEPARTMENT OF THE AIR FORCE	34,477,946	2,295,356	2,496,707	3,122,135	30,392,202	4,085,743

Defense Agencies/Office of the Secretary of Defense

Operation and Maintenance	1,206,868	107,961	96,341	113,965	1,205,306	1,562
Procurement						
Ordnance, vehicles and related equipment	661	9	3	1	577	84
Electronics and communications	9,115	125	455	1,585	4,679	4,435
Other procurement	124,789	9,184	3,484	17,312	92,414	32,375
Undistributed	2,016	—	—	—	—	2,016
Total—Procurement	136,582	9,318	3,942	18,898	97,670	38,912
Research, Development, Test, and Evaluation						
Military sciences	547,364	44,503	40,402	111,600	482,497	64,867
Undistributed	—	—	—	—	—	—
Total—Research, Development, Test, and Evaluation	547,364	44,503	40,402	111,600	482,497	64,867
Military Construction	59,828	381	1,871	1,975	6,997	52,831
Revolving and Management Funds	2,784,608	204,566	193,243	255,156	2,749,282	35,326
Offsetting Receipts	−51	−6	−4	−2	−51	—
Subtotal—Federal Funds	4,735,199	366,722	335,794	501,593	4,541,701	193,498
Trust Funds	—	—	—	—	—	—
TOTAL—DEFENSE AGENCIES OSD	4,735,199	366,722	335,794	501,593	4,541,701	193,498

Defense-Wide

Retired Military Personnel						
Retired Pay, Defense	2,858,000	248,568	249,938	261,207	2,853,234	4,766
Operation and Maintenance	43,986	3,534	2,881	7,666	43,398	588
Research, Development, Test, and Evaluation						
Emergency Fund, Defense	—	—	—	—	—	—
Family Housing	690,163	64,856	44,803	82,582	576,877	113,286
Other—Special Foreign Currency Program	15,162	329	330	359	1,760	13,401
TOTAL—DEFENSE-WIDE	3,607,311	317,288	297,951	341,904	3,475,269	132,041

Office of Civil Defense

Civil Defense	75,206	4,323	2,946	7,814	69,708	5,455

Military Assistance

Federal Funds	415,162	69,246	12,878	44,626	411,497	3,665
Trust Funds	2,340,201	41,312	30,396	27,573	107,775	2,232,426
TOTAL—MILITARY ASSISTANCE	2,755,364	110,558	43,274	72,199	519,272	2,236,091

NOTE: All outlay amounts are on a net Treasury basis (gross payments less reimbursement collections), whereas obligations and unpaid obligations are on a gross basis (inclusive of reimbursable activity performed by components of DOD for each other). Therefore, unpaid obligations as of the end of the reporting month cannot be computed from other figures in this report. Details do not add to totals due to rounding.

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DEFENSE PROCUREMENT

Pursuant to a decision by the Office of Management and Budget, Executive Office of the President, that as a condition for continuation of the **Defense Industry Bulletin**, information readily available in other media may not be published here. Defense Procurement will not be published after this issue. Readers may obtain this information from:

Commerce Business Daily
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402.

Remittance for the **Commerce Business Daily** must accompany the order: $25 annually, plus $30.25 if air mail delivery is requested.

Contracts of $1,000,000 and over awarded during the month of October 1970.

DEFENSE SUPPLY AGENCY

1—**Garland Foods Inc., Dallas, Texas, $5,000,000. Approximately 7,000,000 pounds of canned ham (8–14 pound cans). Defense Personnel Support Center, Philadelphia, Pa. DSA 13H–71–D–2038.

13—*DeRossi & Sons, Co., Vineland, N.J. $1,561,595. 97,875 men's tropical wool/polyester coats for the Army. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–71–C–0433.

14—Endicott-Johnson Corp., Endicott, N.Y. $1,080,670. 167,160 pairs of men's black oxford shoes. Defense Personnel Support Center, Philadelphia Pa. DSA 100–71–C–0445.

19—*C. M. London Co., New York, N.Y. $2,545,715. 2,871,000 linear yards of cotton duck cloth (cotton and rayon filling). Laurens and Spartenburg counties, S.C. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–71–C–0404.

—Island Creek Coal Sales Co., Cleveland, Ohio. $1,400,500. Approximately 112,500 tons of bituminous coal. Holden, Scarlet Glen, and Emmett, W. Va. Defense Fuel Supply Center, Alexandria, Va. DSA–600–71–D–0107.

21—*International Container Service, Inc. Seattle, Wash. $1,138,072. Warehouse and storage services. DSA–130–71–D–0114.

22—*Kirkpatrick Coal Co., Memphis, Tenn. $1,083,275. 138,100 tons of bituminous coal. Caney Creek and Wright, Ken. Defense Fuel Supply Center, Alexandria, Va. DSA 600–71–D–0192.

27—*Logan & Kanawha Coal Co., Inc., Cincinnati, Ohio. $1,800,000. 120,000 tons of bituminous coal. Dove, Lark and Home Creek, Va. Defense Fuel Supply Center, Alexandria, Va. DSA–600–71–D–0195.

30—*C. M. London Co., New York, N.Y. $1,045,491. 247,000 linear yards of nylon twill cloth. Columbus, Ga. and Westerly, R.I. Defense Personnel Support Center, Philadelphia, Pa. DSA–100–71–C–0515.

—General Foods Corp., White Plains, N.Y. $1,128,575. 1,924,920 units of enriched instant rice (unit = one 150-gram bag and two 325-gram bags). Dover, Del. Defense Personnel Support Center, Philadelphia, Pa. DSA 13H–71–C–5423.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—*Small Business Firm — Company —Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency — Contract Number.

DEPARTMENT OF THE ARMY

1—*Mark Construction, Inc., Honolulu, Hawaii. $1,225,000. Construction of a rigid frame laundry with concrete foundation at Schofield Barracks, Hawaii. Army Engineer Division, Pacific Ocean, Fort Armstrong, Hawaii. DA–CA84–71–C–0011.

—Union Carbide Corp., New York, N.Y. $2,501,571. BA–4386/PRC–25 dry batteries, ancillary items, and high-low temperature and internal pressure production testing. Charlotte, N.C. Army Electronics Command, Philadelphia, Pa. DA–AB05–71–C–4431.

—Stanford Research Institute, Menlo Park, Calif. $3,437,380 (contract modification). Continued studies in research and development of the Anti-Ballistic Missile defense system. Huntsville, Ala. and Menlo Park. Safeguard Systems Command, Huntsville, Ala. DA–HC60–60–C–0004.

5—The Army Ammunition Procurement and Supply Agency, Joliet, Ill., awarded the following contracts for metal parts for M429 rocket fuzes:

Hamilton Watch Company, Lancaster, Pa. $1,701,000. DA–AA09–71–C–0051.

General Time Corporations, LaSalle, Ill. $1,672,020. DA–AA09–71–C–0052.

Bulova Watch Company, Jackson Heights, N.Y. $1,109,592. DA–AA09–71–C–0050.

Gibbs Manufacturing and Research Corp., Janesville, Wis. $1,465,000. DA–AA09–71–C–0053.

—Raytheon Co., Bedford, Mass. $1,243,437 (contract modification). Supplementary advanced development priority I and II of the Sam D missile systems. Orlando, Fla. and Bedford, Mass. Army Missile Command, Redstone Arsenal, Huntsville, Ala. DA-AH01-67-C&1996.

—*George M. Meyers, Inc., El Dorado, Kan. $1,014,357. Paving of approximately three miles of road at Fort Riley, Kan. Army Engineer District, Omaha, Neb. DA-CA45-71-C-0043.

—Western Electric Co., New York, N.Y. $2,033,380 (contract modification). Continued studies on the advanced ballistic missile defense systems. New York, N.Y. and Santa Monica, Calif. Safeguard Systems Command, Huntsville, Ala. DA-HC60-69-C-0008.

—Westinghouse Electric Corp., Mobile, Ala. $1,203,707. Design and manufacture of power transformers in Muncie, Ind., and delivery to Carter's Dam, Coosawatee River, Georgia. Army Engineer District, Mobile, Ala. DA-CW01-71-C-0038.

—Pace Co., Memphis, Tenn. $1,777,500. Loading, assembling and packing of 225,000 cases of 60mm illuminating M83A3 shells, with M65A1 fuzes. East Camden, Ark. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-71-C-0008.

6—*Collo Somers Co., Vidalia, Ga. $3,201,775. Construction of bachelor officer quarters including site work and utilities at Fort Gordon, Ga. Army Engineer District, Savannah, Ga. DA-CA21-71-C-0054.

—McLean Contracting Co., Baltimore, Md. $1,770,410. Removal of existing jetty and construction of a new stone jetty on the inland waterway from Delaware River to Chesapeake Bay. Work also includes 100,000 tons of stone for jetty construction and 700,000 cubic yards of dredging for canal improvement and jetty foundation excavation. Army Engineer District, Philadelphia, Pa. DA-CW61-71-C-0008.

7—The Army Ammunition Procurement and Supply Agency, Joliet, Ill. is awarding two contracts for HE M406, 40mm projectile metal parts:

AVCO Corp. Precision Products Division, Richmond, Ind. $2,912,130. DA-AA09-71-C-0025.

Heckethorne Manufacturing Co., Dyersburg, Tenn. $10,140,000. DA-AA09-71-C-0024.

—Bell Helicopter, Fort Worth, Tex. $4,942,500. 15 UH-1N helicopters. Hurst, Tex. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-C-0205.

—UNECO, Bellevue, Neb. $1,705,443. Metal parts fo rthe HEI M56A3 20mm projectile. Frankford Arsenal, Philadelphia, Pa. DA-AA25-71-C-0145.

8—The U.S. Army Ammunition Procurement and Supply Agency, Joliet, Illinois, is awarding the following two contract actions:

*U.S. Components Corp., Mt. Clemens, Mich. $1,007,868. Metal parts for the booster, adapter, M148 GP bomb. DA-AA09-71-C-0071.

Harvey Aluminum, Inc., Torrance, Calif. $4,387,382. M118 40mm cartridge cases. DA-AA09-71-C-0030.

—AVCO Corp., Charleston, S.C. $4,676,000. Overhaul and modification of 668 T-53-L13/13A turbine engines applicable to the UH-1H/AH1G aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-69-A-0308.

—Bell Helicopter, Amarillo, Tex. $3,245,428. Repair of 76 UH-1 series crash-damaged aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-68-D-0056.

9—*Western States Construction Co., Inc. $1,098,300. Temporary housing services for government personnel at the Grand Forks, N.D., ABM Safeguard site to include furnishing, operating and maintaining a mobile home park complete with 85 three bedroom mobile homes. Army Engineer District, Omaha, Neb. DA-CA45-71-C-0044.

—Peter Kiewit Sons Co., Vancouver, Wash. $6,389,817. Clearing and grading of one-half mile and relocation of Montana State Highway 37 at Libby Dam, Montana. Army Engineer District, Seattle, Washington. DA-CW67-71-C-0027.

—AVCO Corp., Stratford, Conn. $2,331,397. 850 modification kits for T-53 gas turbine engine for the UH-1 aircraft. Army Aviation Systems Command, St. Louis, Mo. DA-AJ01-70-A-0334.

12—FMC Corp., San Jose, Calif. $2,106,000. Inspection and production engineering for the self-propelled, full-tracked M113A1 vehicle. Army San Francisco Procurement Agency, Oakland, Calif. DA-04-200-AMC-02929.

—*Colte Somers Co., Vidalia, Ga. $4,670,600. Construction of Southeast Signal School facilities, with supporting utilities and site preparation at Fort Gordon, Ga. Army Engineer District, Savannah, Ga. DA-CA21-71-C-0024.

—Olin Corp., Stamford, Conn. $15,843,431 (contract modification). Operation and maintenance of a government-owned facility at the Badger Army Ammunition Plant, Baraboo, Wis. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-AA09-69-C-0014.

—Colt's, Inc., Hartford, Conn. $20,847,516. 5.56mm M16A1 rifles. Army Weapons Command, Rock Island, Ill. DA-AF-C-0003.

13—*Joseph S. Floyd Corp., Norfolk, Va. $1,025,000. Construction of a Sprint/Spartan clean room at the Tar Heel Army Ammunition Plant, Burlington, N.C. Army Engineer District, Savannah, Ga. DA-CA21-71-C-0023.

—Holloway Construction Co., Wixom, Mich. $6,913,799. Construction of a Dam, spillway and appurtenant works, and relocation of railroad and roads at the Clarence J. Brown Dam and Reservoir Project, Clark County, Ohio. Army Engineering District, Louisville, Ky. DA-CW27-71-C-0054.

—The Frankford Arsenal, Philadelphia, Pa. has awarded the following two contract actions:

*Barry L. Miller Engineering, Inc., Hawthorne, Calif. $2,450,761. 26,019,300 M14A2 metallic belt cartridge links. DA-AA25-71-C-0158.

Teledyne Mechanical Products Co., El Monte, Calif. $1,278,149. 13,149,680 M14A2 metallic belt cartridge links. DA-AA25-71-C-0159.

14—Brown Engineering Co., Huntsville, Ala. $1,656,931 (contract modification). Ballistic aerial targets. Army Missile Command, Huntsville, Ala. DA-AH01-70-C-0218.

—General Motors Corp., Indianapolis, Ind. $2,918,947. M60 tank transmissions. Army Tank Automotive Command, Warren, Mich. DA-AE07-71-C-0049.

15—Remington Arms Co., Inc., Bridgeport, Conn. $6,171,295. Operation of a government-owned ammunition producing facility at Lake City Army Ammunition Plant, Independence, Mo. Army Ammunition Procurement and Supply Agency, Joliet, Ill. DA-49-010-AMC-00003A.

—American Institutes for Research, Pittsburg, Pa. $1,063,000 (contract modification). Research and scientific studies for the Army Social Science Research Program, Kensington, Md. Army Research Office, Arlington, Va. DA-HC-19-70-C-0015.

—Tasker Industries, Bermite Div., Saugus, Calif. $1,374,450. Mk 125 Mod 5 igniters for 2.75 inch rocket motors. Indio, Calif. The Picatinny Arsenal, Dover, N.J. DA-AA21-71-C-0186.

16—The Army Ammunition Procurement and Supply Agency, Joliet, Ill. is issuing the following four contracts:

Kisco Co., Inc., St. Louis, Mo. $3,158,653. Metal parts for 106mm M94B1 cartridge cases. DA-AA09-71-C-0082. $11,599,665. Metal parts for 105mm M14B4 cartridge cases. Fontana, Calif., Chicago, Ill., Maumee and Willoughby, Ohio, St. Louis, Mo. and Huntsville, Ala. DA-AA09-71-C-0074.

Norris Industries, Los Angeles, Calif. $11,047,300. Metal parts for 105mm M14B4 cartridge cases. Pico Rivera, Calif. DA-AA09-71-C-0073.

*Orweld Steel Products Corp., Ellsworth, Mich. $5,909,973. Metal parts for 105mm, TP-T/M489 projectiles. DA-AA09-71-C-0093.

19—Ralph M. Parsons Co., Los Angeles, Calif. $1,234,553 (contract modification). Architect engineer services for the Safeguard engineer services for the Safeguard missile site, radar site and site adaption of this design to Grand Forks, N.D., safeguard site. Army Engineering Division, Huntsville, Ala. DA-CA87-68-C-0001.

—The Safeguard System Command, Huntsville, Ala. is the contracting activity for the following two contracts:

McDonnell Douglas Corp., Huntington Beach, Calif. $10,111,787 (contract modification). Flight test experiment with the purpose of developing missile technology for ABM application. DA-AH-68-C-1237.

Kaman Nuclear Corp., Colorado Springs, Colo. $1,142,183 (contract modification). Lethality and vulnerability analysis for the Safeguard system. DA-HC60-68-C-0020.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill. is awarding the following two contracts:

Bulova Watch Co., Inc., Warwick, R.I. $1,620,000. Head assemblies for M525 fuzes. DA-AA09-71-C-0058.

REDM Corp., Wayne, N.J. $4,104,000. Head assemblies for M525 fuzes. DA-AA09-71-C-0057.

20—Federal Electric Corp., Paramus, N.J. $11,191,947. Operations, maintenance, communications engineering and training including operation of two separate area maintenance support facilities in support of the existing integrated communications systems in the Republic of Vietnam. Army Strategic Communications Command, Fort Huachuca, Ariz. DA-EA18-71-C-0024.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill. is issuing the following three contract actions:

Airport Manufacturing Corp., Martin, Tenn. $1,673,100. Metal parts for 2.75 inch, XM229 rocket warheads. Union City, Tenn. DA-AA09-71-C-0096.

Honeywell, Inc., Hopkins, Minn. $2,149,655. M219E1 grenade fuzes. Twin Cities Army Ammunition Plant, New Brighton, Minn. DA-AA09-71-C-0086.

Scoville Manufacturing Co., Waterbury, Conn. $1,244,401. M219E1 grenade fuzes. DA-AA09-71-C-0087.

21—Futuronics Corp., Port Washington, N.Y. $5,168,476. AN/GRC-106 radio set; RT-834 receiver-transmitter and ZM-3349 amplifier. Freeport, N.Y. Army Electronics Command, Philadelphia, Pa. DA-AB05-71-C-3708.

—LTV Electrosystems, Inc., Huntington, Ind. $18,037,221. Components of the AN/VRC-12 compact, light weight vehicular radio sets. Army Electronics Command, Philadelphia, Pa. DA-AB05-67-C-0171.

—The Army Ammunition Procurement and Supply Agency, Joliet, Ill. is awarding the following two contracts:

Chamberlain Manufacturing Corp., Waterloo, Iowa. $1,509,800. Metal parts for warheads for 2.75 inch, M151 rockets. DA-AA09-71-C-0098.

Batesville Manufacturing Co., Batesville, Ark. $1,318,950. Metal parts for M151 warheads for 2.75 inch rockets. DA-AA09-71-C-0099.

—Mid-County Asphalt Co., Euless, Tex. $1,770,249. Construction of two miles of bituminous road relocations at the Lavon Reservoir, Collins County, Tex. Fort Worth Army Engineer District, Fort Worth, Tex. DA-CW63-71-C-0017.

22—Northrop Corp., Anaheim, Calif. $1,556,178. 42,600 WDU-4A/A warheads for the 2.75 rocket. Army Procurement and Suply Agency, Joliet, Ill. DA-AA09-71-C-0022.

23—*Graves Construction Co., Blacksburg, Va. $1,499,000. Construction of a one-story earth-covered building to match existing structures at the Radford Army Ammunition Plant, Radford, Va. Army Engineer District, Baltimore, Md. DA-CA31-71-C-0032.

—*Red-Samm Mining Co., *Venture Construction, Inc., and *Shoreline Construction Co. (joint venture). Bellevue, Wash. $3,177,600. Construction of a water supply system to the Malmstrom, Montana Safeguard site. Pondera and Toole Counties, Montana, Army Engineer District, Seattle, Wash. DA-CA67-71-C-0008.

26—The Picatinny Arsenal, Dover, N.J., is awarding the following contracts:

Muncie Gear Works, Inc., Muncie, Ind. $2,696,772. Nozzle and fin assemblies for 2.75 inch rocket motors. DA-AA21-71-0167.

FTS Corp. div. of HITCO, Denver, Colo.

and data. Naval Electronics Systems Command, Washington, D.C. N00039-71-C-0011.

—McDonnell-Douglas Corp., St. Louis, Mo. $5,515,000. Long lead items in support of F-4E and RF-4C aircraft for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-69-C-0521.

—Singer-General Precision, Inc., Silver Spring, Md. $2,000,000. Device 2F87(T), T-3C tactics trainer, technical data information services and support. Naval Training Device Center, Orlando, Fla. N61339-70-C-0038.

—R. C. Hedreen Co., Seattle, Wash. $2,584,000. Construction of a woodworking shop at the Naval Shipyard, Bremerton, Wash. Naval Facilities Engineering Command, Western Division, San Bruno, Calif. N62474-70-C-0886.

8—Continental Electronics Manufacturing Co., Dallas, Tex. $3,536,438. Omega antenna tuning sets, repair parts, services, support and data. Naval Electronic Systems Command, Washington, D.C. N00039-71-C-0012.

—Goodyear Aerospace Corp., Akron, Ohio. $15,555,775. Production of Subroc guided Mk 28, Mod 1 missile. Naval Ordnance Systems Command, Washington, D.C. N00017-71-C-1401.

—Lockheed Aircraft Corp., Burbank, Calif. $57,000,004 (contract modification). Incremental funding for the development of the S-3A aircraft and exercising an option for two additional test aircraft. Naval Air Systems Command, Washington, D.C. N00019-69-C-0385.

9—Gould, Inc., Trenton, N.J. $1,028,386. Lead acid storage batteries. Trenton, Monroe, Mich. and Kankakee, Ill. Naval Purchasing Office, Washington, D.C. N00600-71-C-0353.

—Westinghouse Electric Corp., Baltimore Md. $8,000,000 (contract modification). Increase the scope of work and increase the limitation of authorization for pilot production of Mk 48, Mod 1 torpedoes with supporting equipment. Lansdowne, Md. and Friendship Airport facilities, Md. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-1211.

—Clevite Ordnance Division, Gould, Inc. $10,000,000. Pilot production of Mk 48, Mod 1 torpedoes with supporting equipment. Naval Ordnance Systems Command, Washington, D.C. N00017-71-C-1302.

12—Martin Marietta Corp., Baltimore, Md. $1,523,764. Prototyping of DIFAR (Directional Finding and Ranging) and related equipment on S-2E aircraft. Naval Air Systems Command, Washington, D.C. N00019-71-C-0076.

—R. C. Hedreen Co., Seattle, Wash. $1,324,342. Construction of a bachelor officers quarters, with mess, at Naval Air Station, Whidbey Island, Wash. Commander, Western Division, Naval Facilities Engineering Command, San Bruno, Calif. N62474-71-C-4023.

13—Westinghouse Electric Corp., Wilkins Township, Pa. $25,570,000. Nuclear reactor compartment components. Naval Ship Systems Command, Washington, D.C. N00024-71-C-5076.

—Littons Systems Inc., Pascagoula, Miss. $2,677,647. Advance preparation for the overhaul of the nuclear powered attack submarine, USS Gato (SSN 615). Naval Ship Systems Command, Washington, D.C. N00024-71-C-0223.

14—Susquehanna Corp., Alexandria, Va. $2,317,554 (contract modification). Mk 30 Mod 2 rocket motors for Standard missiles. Naval Ordnance Systems Command, Washington, D.C. N00017-68-C-2103.

—General Dynamics Corp., Groton, Conn. $77,900,000. Construction of the nuclear-powered, electric drive submarine (SSN 685). Naval Ship Systems Command, Washington, D.C. N00024-70-C-0307.

16—Univac Div. of Sperry Rand Corp., St. Paul, Minn. $9,962,000. 41 AN/UYK-7 computers. Naval Ship Systems Command, Washington, D.C. N00024-71-C-1039.

—Sperry Gyroscope Co. Div. of Sperry Rand Corp., Great Neck, N.Y. $1,675,000 (contract modification). Mk 76 Mods 3 and 5 fire control systems for Terrier missiles. Naval Ordnance Systems Command, Washington, D.C. N00017-70-C-2308.

—General Dynamics Corp., Electric Boat Div., Groton, Conn. $11,677,900. Overhaul of the nuclear powered submarine USS Sturgeon (SSN-637). Naval Ship Systems Command, Washington, D.C. N00024-70-C-0227.

19—Sperry Rand Corp., Syosset, N.Y. $17,405,000. Poseidon (C-3) Inertial navigation subsystem equipments for five ships and two sets of training equipment. Naval Ship Systems Command, Washington, D.C. N00024-71-C-5112.

—General Electric Co., Burlington, Vt. $1,869,758. Design, develop, test and deliver 21 20mm light weight gun pods to be used on OV-10, A-4, A-7, F-4B aircraft and various helicopters. Naval Regional Procurement Office, Los Angeles, Calif. N00123-71-C-0194.

20—FMC Corp., Minneapolis, Minn. $7,865,000. Engineering development of the Mark 26 Mod 0, 1 and 2 guided missile launching system. Fridley, Minn. Naval Ordnance Systems Command, Washington, D.C. N00017-68-C-2109.

—Honeywell, Inc., West Covina, Calif. $1,738,520. AN/SQS-26CX modular addition to sonar training equipment devices, 14A2B and 14A2F. Naval Training Device Center, Orlando, Fla. N61339-70-C-0078.

—General Dynamics Corp., Groton, Conn. $1,014,000. Planning yard services for the NR-1 nuclear-powered ocean engineering and research submarine. Naval Ship Systems Command, Washington, D.C. N00024-71-C-0222.

—Swiftships, Inc., Morgan City, La. $1,184,982. Construction of six 65-foot aluminum Mark I patrol boats. Naval Ship Systems Command, Washington, D.C. N00024-71-C-0211.

—United Aircraft Corp., Stratford, Conn. $1,000,000. Long lead-time items for the CH-53C helicopter program for the Air Force. Naval Air Systems Command, Washington, D.C. N00019-69-C-0621.

21—Stromberg-Datagraphix, Inc., San Diego, Calif. $1,900,000. AN/ASA-70 tactical display groups. Naval Air Systems Command, Washington, D.C. N00019-71-C-0151.

22—F&M Systems Co., Dallas, Tex. $2,990,443. Special electronic systems including UHF/VHF antennas. Naval Ship Systems Command, Washington, D.C. N00024-71-C-1088.

23—ITT Gilfillan, Inc., Van Nuys, Calif. $1,692,550. Manufacture of AN/SPN-43(A) radar pedestals. Naval Electronic Systems Command, Washington, D.C. N00039-71-C-0105.

—Raytheon Co. North Dighton, Mass. $1,927,524. Seven Navy nuclear submarine (SSN) signal data convertors, which includes all technical data, installation kits, repair parts, related engineering services and support training. Naval Ship Systems Command, Washington, D.C. N00024-71-C-1083.

26—Aluminum Company of America, Pittsburg, Pa. $1,832,269. Chemical aluminum powder used in Mark 81/82/83/84 bombs, Rockdale, Tex. Naval Ships Parts Control Center, Mechanicsburg, Pa. N00104-71-C-A021.

—The Naval Air Systems Command is awarding the following contracts:

Raytheon Co., Lexington, Mass. $5,544,026. Guidance and control groups for Sidewinder IC for the Navy and Air Force. Lowell, Mass. N00019-70-C-0209.

Williams Reasearch Corp., Walled Lake, Mich. $1,586,150. YJ400-WR-400 air turbine jet engines. N00019-71-C-0075.

Royal Industries, Santa Ana, Calif. $1,236,823. 600-gallon capacity, external fuel tanks for the Air Force. N00019-71-C-0074.

27—Baugh and Coody, Inc., Albany, Ga. $2,347,000. Construction of a 4600-man mess hall, Second Male Recruit Camp at Naval Training Center, Orlando, Fla. Commander, Southern Division, Naval Facilities Engineering Command, Charleston, S.C. N62467-68-C-0345.

—Energy Systems, Inc., Palo Alto, Calif. $3,140,530. AN/TRC-97A tropospheric communications system with peripheral equipment and associated data. Naval Electronics Systems Command, Washington, D.C. N00039-71-C-0314.

—United Aircraft Corp., Stratford, Conn. $1,226,928. Progressive aircraft rework and related services on VH-3A helicopters. Stratford and Bridgeport, Conn. Naval Air Systems Command, Washington, D.C. N00019-71-C-0109.

28—The Naval Ship Systems Command is issuing the following two contracts:

General Dynamics Corp., Electric Boat Div., Groton, Conn. $3,727,096. Preparation work on the overhaul of nuclear submarines USS Nautilus (S-SN 571) and USS Tullibee (SSN-597). N00024-71-C-0238.

Newport News Shipbuilding and Dry Dock Co., Newport News, Va. $2,580,945. Advance planning and design of the Poseidon (C-3) conversion and overhaul of the USS Henry Stimson (SSBN 655). N00024-71-C-0209.

—McDonnell Douglas Corp., Tulsa, Okla. $1,273,966. Operation, maintenance, and configuration of two electronic countermeasure (ECM) aircraft and equipment including test flights for a period of 12 months. Naval Ordnance Systems Command, Washington, D.C. N00024-71-C-4403.

DEPARTMENT OF THE AIR FORCE

1—Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, is issuing the following two contract modifications:

Texas Instruments, Inc., Dallas, Tex. $1,803,124. Airborne radar equipment (AN/APQ-99). F33657-70-C-0631.

Bourns/CAI, Inc., Barrington, Ill. $4,390,833. Procurement and installation of aerial cameras in RF-4 aircraft. F3657-69-C-1282.

—*MacLeod Co., Cincinnatti, Ohio. $1,624,117. 2600-gallon capacity, water tank trucks. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F0963-71-C-0318.

2—Automatic Electric Co., Northlake, Ill. $1,175,000. Equipment and services applicable to the Overseas Autovon System. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. AF19(628)-596.

5—Cleveland Pneumatic Co., Cleveland, Ohio. $1,633,715. Production of structural components applicable to the main landing gear of C-141 aircraft. Ogden Air Materiel Area, AFLC, Hill AFB, Utah. F42600-71-C-1231.

—Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, is awarding the following contract actions:

Boeing Co., Seattle, Wash. $1,600,000. Research and development of a Short Range Attack Missile (SRAM). AF33(657)-16584.

Texas Instruments, Inc., Dalls, Tex.

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$1,614,000. Procurement of spare parts for AC 130A aircraft. F33657 71 C 0148.

Martin Marietta Corp., Denver, Colo. $4,-[illegible] (contract modification). Design, develop and fabricate Titan III C space boosters and associated aerospace ground equipment. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04695 67 C 0142.

Hayes International Corp., Birmingham, Ala. $2,721,150. Inspection and repair as necessary, maintenance and modification of C 130 aircraft. Warner-Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603 70 C 0701.

6 General Electric Co., Philadelphia, Pa. $15,[illegible] (contract modification). Production of the Mark 12 reentry system. Space and Missiles Systems Organization, Los Angeles, Calif. F04701 68 C 0175.

General Dynamics Corp., Fort Worth, Tex. $5,000,000 (contract modification). F 111 aerospace ground equipment. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. AF33(657)-13403.

Honeywell, Inc., Tampa, Fla. $1,695,000 (contract modification). Production of multiplexer sets and associated spare parts. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601 70 C 1405.

Lockheed Aircraft Corporation, Marietta, Ga. $4,602,657. Procurement of spare parts for C 5A aircraft. Detachment 31, San Antonio Air Materiel Area, AFLC, Marietta, Ga. AF33(657) 15053.

Sperry Rand Corporation, Washington, D.C. $2,986,000. Electronic data processing equipment. Roseville, Minn. 2750th Air Base Wing, Wright-Patterson AFB, Ohio. F33600 71 F 0851.

8 TRW, Inc., Redondo Beach, Calif. $1,-[illegible]. Services and data for the integration and checkout of a tactical air control system. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628 70 C 0313.

Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio, is awarding the following contract actions:

General Electric Company, Cincinnati, Ohio. $1,000,000 (contract modification). Development of an advanced turbine engine gas generator, Evendale, Ohio. F33657 70 C 0340.

Westinghouse Electric Corp., Baltimore, Md. $2,000,000. Modification of B 57G aircraft. F33657 68 C 1050.

General Electric Co., Utica, N.Y. $1,-100,000. Procurement of canisters used in electronic countermeasures pods for tactical aircraft. F33657 71 C 0147.

LTV Electrosystems, Greenville, Tex. $1,000,[illegible]. Modification of OV-10 aircraft. F33657 71 C 0358.

9 Ogden Air Materiel Area, AFLC, Hill AFB, Utah, is awarding the two following contract actions:

Sargent-Fletcher Company, El Monte, Calif. $9,780,048. Production of 750 pound bombs. F42600 71 C-1177.

Menasco Manufacturing Co., Fort Worth, Tex. $2,055,935. Production of component parts of the main landing gear for B-52 aircraft. F42600-71-C-1234.

12 Chromalloy American Corp., San Antonio, Tex. $1,038,654. Repair and protective coating services for J-57 aircraft engine compressor blades. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34601 70 D 1105.

Mitre Corp., Bedford, Mass. $16,058,000. Research and development in the field of advanced information and communication systems. Electronic Systems Division, AFSC, L. G. Hanscom Field, Mass. F19628 71 C 0002.

13 Hughes Aircraft, Culver City, Calif. $2,-983,676. Modification kits and spare parts for the improvement of weapon control systems on F 106 and F-101 aircraft. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603 71 C 3427.

Boeing Co., Seattle, Wash. $2,023,000. Design, development, study and test programs for Minuteman space missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701 69 C-0153.

15 Cessna Aircraft Co., Wichita, Kan. $2,-748,001. A-37B aircraft testing program. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657 71 C 0103.

Chromalloy American Corp., San Antonio, Tex. $1,331,811. Repair services for vane and shroud assemblies for J-57 jet aircraft engines. Oklahoma City Air Materiel Area, AFLC, Tinker AFB, Okla. F34608 70 D 0212.

*QED Modular Buildings, Inc., Richmond, Calif. $1,178,093. 14 modular, relocatable dependent school buildings. Civil Engineering Center, AFSC, Wright-Patterson AFB, Ohio. F33615 71 C-1081.

FWD Corp., Clintonville, Wisc. $1,189,282. Eight fire fighting trucks. Warner Robins Air Materiel Area, AFLC, Robins AFB, Ga. F09603 71 C 0343.

16 R. G. LeTourneau, Inc., Longview, Tex. $1,308,844. Procurement of material handling equipment. San Antonio Air Materiel Area, AFLC, Kelly AFB, Tex. F41608 69 D-6504.

19 Kollsman Instrument Corp., Elmhurst, N.Y. $7,518,000. AAU 19/A altimeter instruments for aircraft. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657 71 C 0109.

Thiokol Chemical Corp., Bristol, Pa. $5,-158,181. Production of stage I motors for Minuteman III missiles, Brigham City, Utah. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701 69 C 0107.

20 Rand Corp., Santa Monica, Calif. $6,-000,000. Aerospace studies and research. Office of Scientific Research, AFSC, Arlington, Va. F44620 67 C 0045.

21 General Motors Corp., Delco Electronics Div., Milwaukee, Wisc. $8,470,344. Design, development, fabrication and delivery of Titan IIIC inertial guidance system. Space and Missiles Systems Organization, Los Angeles, Calif. F04701-71-C 0128.

Bendix Corp., Electrodynamics Div., North Hollywood, Calif. $6,825,000. Modification of airborne radar equipment. Sylmar, Calif. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-0730.

22 Northrop Corp., Norwood, Mass. $2,-653,895. Production of electronic components applicable to the guidance and control system for Minuteman III. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0160.

Thiokol Chemical Corp., Brigham City, Utah. $3,800,000. Production of illumination flares. Armament Development and Test Center, ALFC, Elgin AFB, Fla. F08635-71-C-0040.

23 The Ogden Air Materiel Area, AFLC, Hill AFB, Utah, is awarding the two following contracts for production of dispensers for air munitions:

Mossfield Industries, Inc., Garland, Tex. $4,080,095. F42600-71-C-1264.

Lanson Industries, Cullman, Ala. $4,-074,409. F42600-71-C-1220.

Boeing Co., Wichita, Kan. $1,147,474. Modification of B-52 aircraft. Oklahoma City Air Materiel Area, Tinker AFB, Okla. F34601-69 C-3987.

26 Boeing Co., Seattle, Wash. $27,100,000. Long lead effort and data in support of the FY 1971 production of the short range attack missile (SRAM). Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-70-C-0870.

27 Boeing Co., Seattle, Wash. $1,885,497. Electronic components applicable to Minuteman III weapons system. Ogden Air Materiel Area, Hill AFB, Utah. F04600-70-A-0084.

Lockheed Aircraft Corp., Marietta, Ga. $9,030,029. Production and modification of C-141 aircraft. Aeronautical Systems Division, Wright-Patterson AFB, Ohio. AF33657-8835.

Sylvania Electric Products, Inc., Needham, Mass. $5,485,774. Operate, maintain and perform minor modification to the missile tracking radar system at Kwajalein Atoll. Electronic Systems Command, AFSC, L. G. Hanscom Field, Mass. F19628-70-C-078.

28 General Dynamics Corp., Fort Worth, Tex. $35,708,108 (contract modification). Research and development of F-111A and FB-111A aircraft. Aeronautical Systems Division, Wright-Patterson AFB, Ohio. AF33(657)-8260.

30 American Standard, Inc., Kansas City, Mo. $1,132,840. VHF communication system for UH-1H helicopters. Aeronautical Systems Division, AFSC, Wright-Patterson AFB, Ohio. F33657-71-C-0259.

Boeing Co., Seattle, Wash. $1,594,963 (contract modification). Procurement of long lead time of spare parts for short range attack missiles (SRAM). Oklahoma Air Materiel Area, Tinker AFB, Okla. F33657-70 C 0876. $1,013,040. Spare parts and force modernization ground equipment for Minuteman III missiles, Ogden, Utah and Seattle, Wash. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-70-C-0136.

Honeywell, Inc., St. Petersburg, Fla. $11,-575,000. Guidance and control systems for Minuteman III missiles. Space and Missile Systems Organization, AFSC, Los Angeles, Calif. F04701-69-C-0176. $3,800,014. Production of components for Minuteman III guidance and control system. Space and Missile Systems Organization, Los Angeles, Calif. F04701-69-C-0176.

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Lasers Map V/STOL Airflow in AEDC Research

Laser technology, developed and used at the Air Force Systems Command's Arnold Engineering Development Center (AEDC), Arnold AFS, Tenn., is playing a key role in a research program designed to improve V/STOL aircraft. Object of the program, sponsored by the Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio, was to construct a 3-dimensional mathematical model of the flow field created when the downwash of a helicopter or V/STOL aircraft strikes the ground in crosswinds of varying intensities.

Principal tool being used by researchers of ARO., Inc., contract operator of the center, is a laser velocimeter developed by the firm's technical staff that simultaneously measures the vertical, horizontal and lateral components of the flow field. In tests so far, only vertical and horizontal component measurements were made. Test conditions created might be compared with a helicopter or V/STOL aircraft in hover with a 5- to 17-miles-per-hour crosswind. Precise velocity measurements at these low speeds are very difficult, and velocity directions change radically in a very short distance.

The laser velocimeter is the only practical way to obtain the needed information since the beams create no disturbance of their own in the flow field. Any attempt to use a mechanical probe would disturb the airflow to such an extent that no valid measurements could be made.

The test series was conducted in a tunnel constructed at the center several years ago specifically for investigation in the V/STOL area. The test section of the tunnel is 30-by-45 inches in cross section and 6 feet long. A flat plate was installed to represent the ground and a vertical air duct to simulate downwash of the aircraft. A smoke generator provided scattering particles for the laser.

The velocimeter uses a 0.015-watt helium-neon laser with a self-aligning optics package that splits the beam into a reference beam and three scatter beams—one for measuring the vertical flow component, one for the horizontal component, and one for the lateral component. A collimating lens focuses the beams at a common point where velocity measurements are made. This focal point can be shifted throughout the flow field, thus providing a velocity map of the field.

The advent of a usable laser velocimeter, as shown in this program, will greatly assist the aerospace engineer in the solution of many of the complex flow field problems associated with obtaining design data for future V/STOL aircraft.

Speed and direction of the flow within the turbulent area are computed by the computerized mathematical model. Crosswind effects are also taken into account. In the immediate future, this type of information could find application in preparation of operating procedures for helicopters. Later, it could aid in the development of V/STOL aircraft by predicting the flow field various aircraft designs would generate.

This research program is under the direction of E. H. Flinn, Chief, V/STOL Stability and Control Group, Air Force Flight Dynamics Laboratory. The laser velocimeter was developed under the direction of A. E. Lennert of ARO, Inc.

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